FEBRUARY 1965 35 CENTS

Popular Science

Monthly

LBJ's HEART
What the medics have learned about his—and yours

RACE CARS of the WORLD
—a complete spec chart

WHICH COMPACT FOR YOU?
PS test-drives Falcon, American, Valiant, Chevy II

TINY TV SETS ARE "IN"
A Buyer's Guide

24 PAGES ON BOATS, HULLS, DOCKS, ETC., ETC.

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recharging takes 10 hours. The battery can be recharged approximately 50 times before it's worn out. A battery replacement costs about $11; that works out to about six cents a viewing hour.

The Delmonico and Sony four-inch sets can also be powered by nonrechargeable flashlight cells; cost per viewing hour is much higher—about 40 cents.

Special interference-killing circuitry and a wide array of accessory mounting brackets and connecting cords let you watch them in moving cars (from the back seat, of course) and boats.

Their small screens—ranging from a snapshot-tiny four inches to a magazine-size nine inches—are perfect for close-range personal viewing.

You'll be surprised how quickly you get used to a small screen. One reason is that you can't see the scanning lines that make up the picture, as you do on a big-screen set.

Don't plan to scrap your big-screen set, though. The personal portables aren't meant for family viewing. More than two viewers in front of a tiny TV—especially the four- and five-inch-screen models—makes a crowd.

They're ruggedly built. The flyweights will ignore jouncing and rough treatment that would send a conventional TV to the repair shop. And they're equipped to travel: A carrying case or snap-on protective front lid comes with (or is an optional accessory for) every set. All of the small TVs performed flawlessly during the PS tests, although we didn't test them long enough to judge their lifetime durability. But a transistorized TV should be more trouble-free than a tube set, since the two major causes of TV-set breakdown—burned-out tubes and circuit components overheated by glowing tubes—have been eliminated.

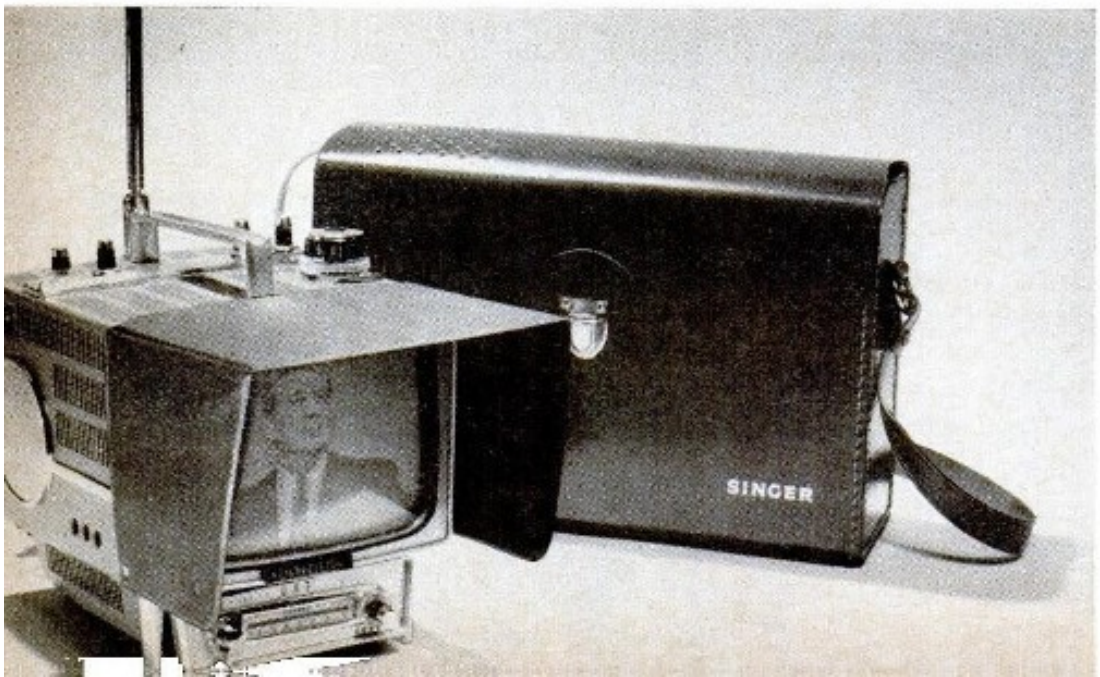
Servicing is no problem. The baby TVs use computer-type plug-in printed circuit boards that most servicemen can fix. For major repairs, the set makers maintain service depots in large cities. The sets are light enough to mail for servicing.

Their performance is amazing—picture quality and sensitivity are excellent. In a side-by-side test in the suburbs the little TVs pulled in 50-mile-plus stations with their built-in monopole telescope antennas alone; a more expensive big-screen set needed a rooftop antenna.

In keeping with the recent federal law, the sets have all-channel tuners, which means they can receive the 70 ultra-high-frequency channels (14-83) as well as the 12 very-high-frequency channels (2-13).

All the little-TV pictures are bright enough for daytime outdoor viewing. At the beach, and on very sunny days, you'll need a sunshade to cut glare on the screen.

How do they sound? Like good-quality transistor radios. To keep power drain low—so they can be battery-powered—these TV sets use relatively low-power



Accessories you'll need to watch the little TVs are shown at left: a sunshade to cut down glare for outdoor viewing, a battery pack to free you from the power lines. Singer's rechargeable battery pack will power its TV about four hours before it needs recharging. Price: $24.95.

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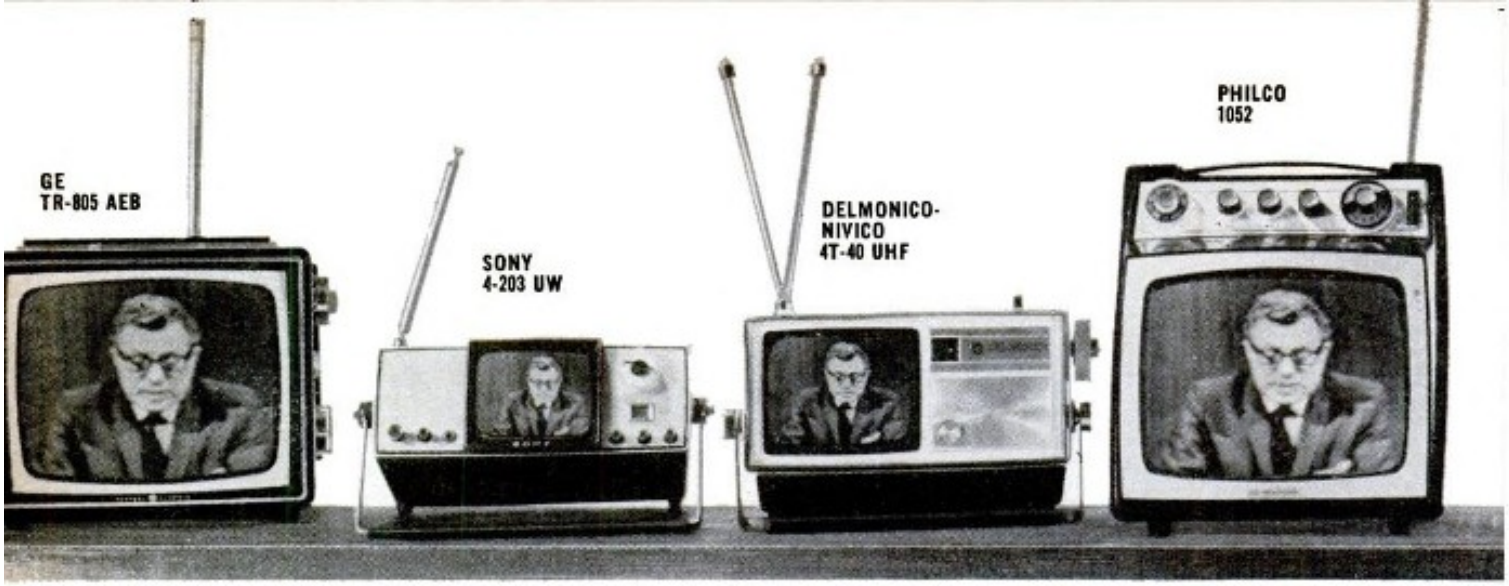


PS ELECTRONICS

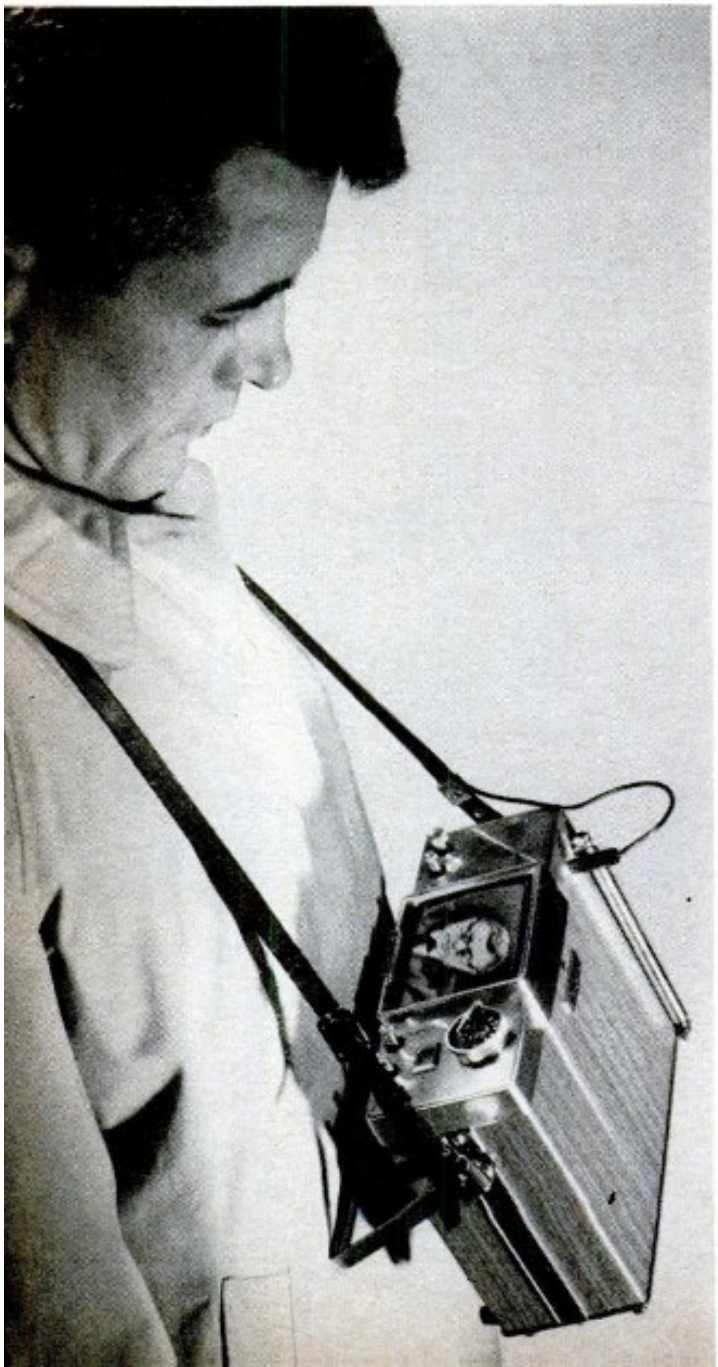
Tiny TV Sets

Transistors make them totable, batteries make them portable. Here's your buyer's guide

By Ronald M. Benrey

THE first time you see one of these little TV sets, you may wonder what all the fuss is about. Didn't we get rid of those midget screens back in the early days of television? But the next time you see one—with the picture turned on—it may be a case of love at second sight.

What's happened to TV is the same thing radio went through. First we had only the bulky set in the living room. Then, with the development of transistors and the art of miniaturization, radios shrank. You could carry one anywhere, even put it in your pocket. That's what these tiny TV sets are—personal. They let you watch your favorite show—in your bedroom, car, or boat, at the beach, on a picnic.



Watch out for lampposts when you view Sony's four-inch set powered with flashlight cells. Where's the antenna? It's wired into the neck strap. The whole package weighs six pounds.

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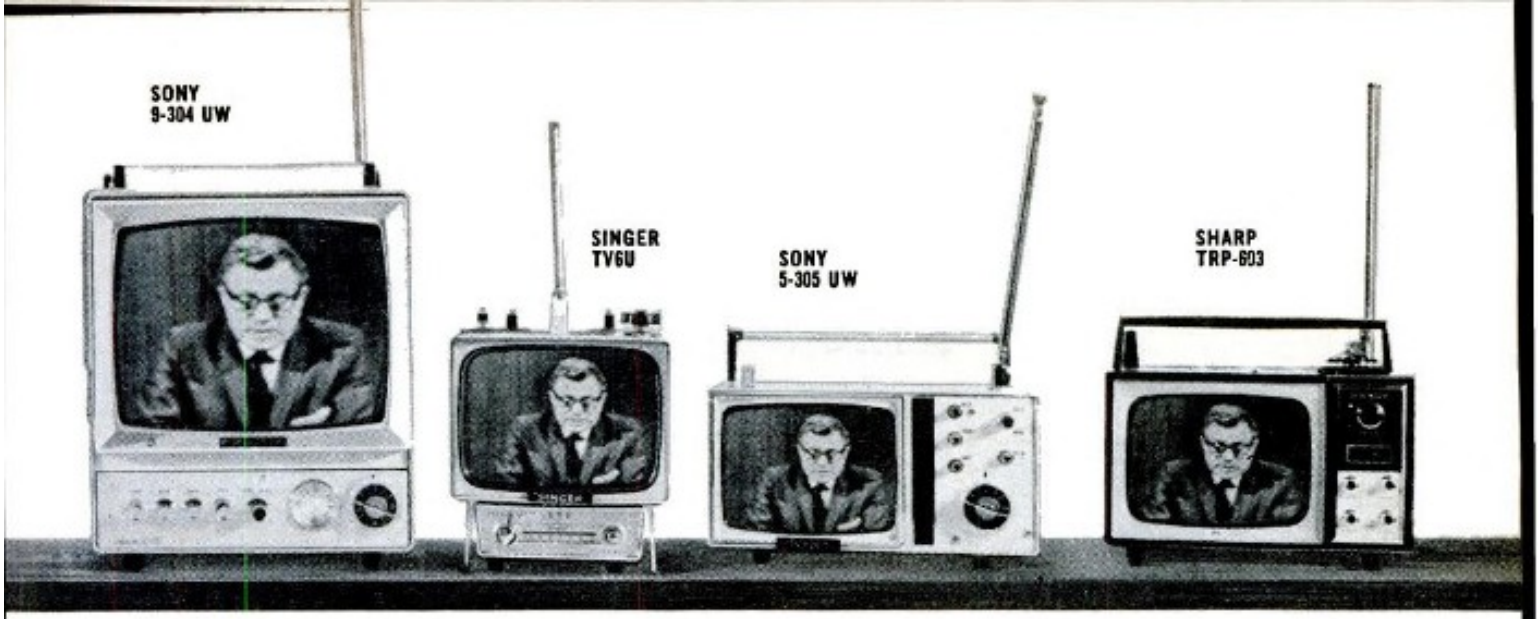

Are "In"

How much do they cost? Prices start around $150 and range up to $200—about the same as big-screen portables.

How good are they? To find out, POPULAR SCIENCE tested the eight little TVs shown above. Seven—all except the GE—are from Japan. We were surprised to learn that the Philco set is imported, since Philco manufactured, in the U.S., the world's first transistor TV back in 1959 [PS, Aug '59]. We viewed them in cities and in the suburbs; we took them to the beach and to mountain resort areas; we tried them in cars.

Our conclusions: The personal portables perform so well that they can't help but be popular. Here's why:

The miniature TVs are genuine portables. They are compact—the largest is as big as a bowling-ball bag, the smallest about the size of a desk dictionary. They are light enough to tote around—most weigh under 10 pounds, about ¼ as much as a big-screen "portable." They are full-size in performance, though, thanks to sophisticated, space-saving, transistor circuitry.

They can be powered by rechargeable battery packs as well as 117-volt AC house current, so you can view them away from the power lines. Most of the sets will run four hours on one charge;

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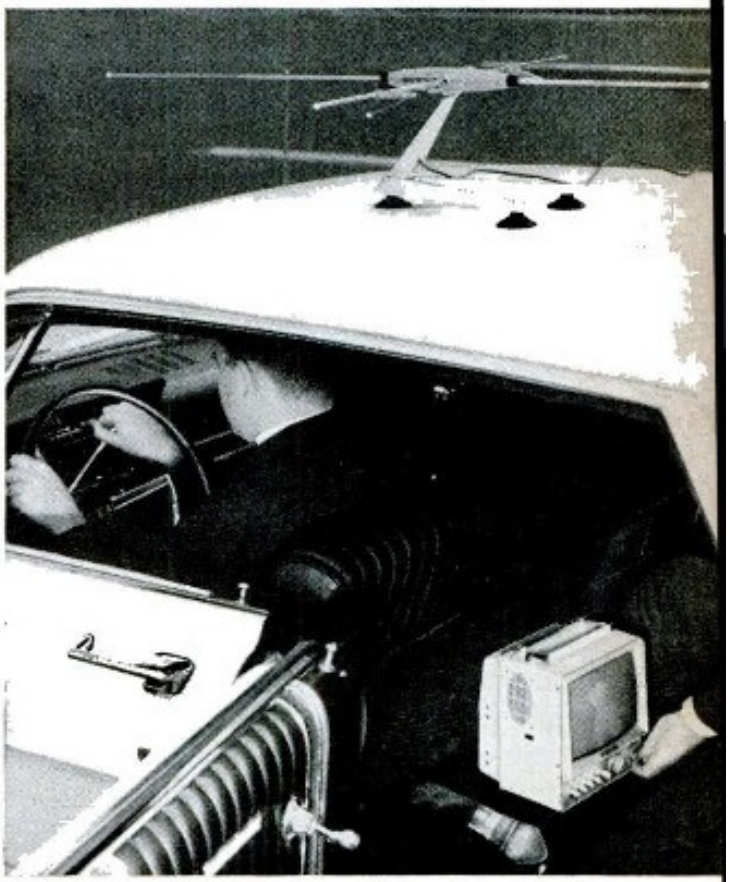

Back-seat auto TV? Sure—if local laws allow. Sony 9-304 (above) gets power from the cigarette-lighter socket. A rooftop Sony VC2A antenna sucks in the signals. Miniature parts keep the tote-alongs tiny. Shown in photo below, Philco's transistorized tuner stage alongside a conventional vacuum-tube unit.

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The race is heating up for

TV You Can Hang on

New ways of controlling light electronically promise to replace picture tubes with flat screens

By R. M. WALSH

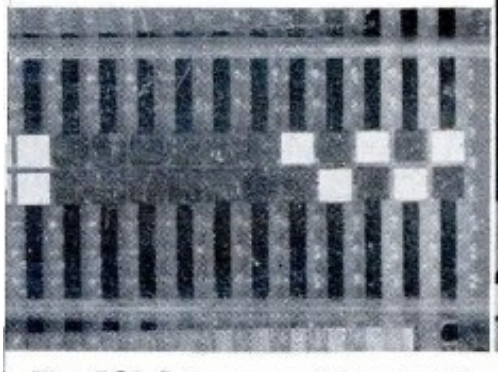
"Tubeless" transistorized TV is great, but wouldn't you like a *really* tubeless set—a flat-screen or "mural" TV, thin enough to fade into the woodwork?

The race is on to eliminate the biggest, most power-hungry tube of them all. The advantage of slim size is obvious; the fringe benefit of reduced electrical appetite would make "portability" really meaningful to the toter.

Matsushita, whose products are well known in this country under the Panasonic label, is eager to be the first with mural television. They certainly have shown the most progress publicly. Earlier this year they displayed a working model of a flat-screen set.

Panasonic flat-screen set really works, although resolution and brightness are poor. Set uses sandwich in which electroluminescent phosphor is the filler between two electrodes. Perhaps available in several years, whole set could be as thin as the screen alone.

a Wall



Tiny RCA flat-screen set has superb resolution and contrast (right) but can handle only still pictures. For real television, system would require third of a million "on-off" circuit elements seen at left.

Electro-optics is the game. To develop a mural screen, scientists and engineers are dipping into a whole new bag of tricks: the growing field of electro-optics, or the science of using and controlling light electronically. Matsushita is using an electro-optical effect already familiar to most all of us—electroluminescence, or EL. The best known EL device is the compact night light that plugs into a wall outlet and glows a dim but reassuring green. Green is the color usually available by EL, but scientists have developed variations in the EL phosphors that produce other colors, including white.

In an EL device, an electroluminescent phosphor is the "filling" in a sandwich. The phosphor layer lies between two electrodes. Although the normal 60-cycle, 120-volt power available directly from a wall outlet can be used, the light output is improved if both voltage and frequency are increased.

Matsushita demonstrated a mural TV prototype with a 13-inch screen, made up of an array or "matrix" of tiny EL cells. The array had 230 lines, each containing 230 cells. This gives a total of 52,900 individual cells that blink on and off to form a picture—still far from the number of cells needed to give the resolution available from a conventional picture tube.

How this system works. Matsushita uses what has come to be known as x,y addressing. Each cell in a vertical column is connected with a transparent electrode on the front of the screen, giving a total of 230 electrode strips. Similarly, each horizontal row is connected with an electrode strip across the back, giving another 230 electrodes. Just as an intersection in New York can be located by designating Fifth Avenue and 42nd Street, an individual element in the EL matrix can be addressed by applying a voltage across, say, vertical column electrode 73 and horizontal row electrode 231. In the Matsushita display, an entire row is addressed at a time, with the appropriate brightness voltages applied to the individual column electrodes simultaneously, but with only

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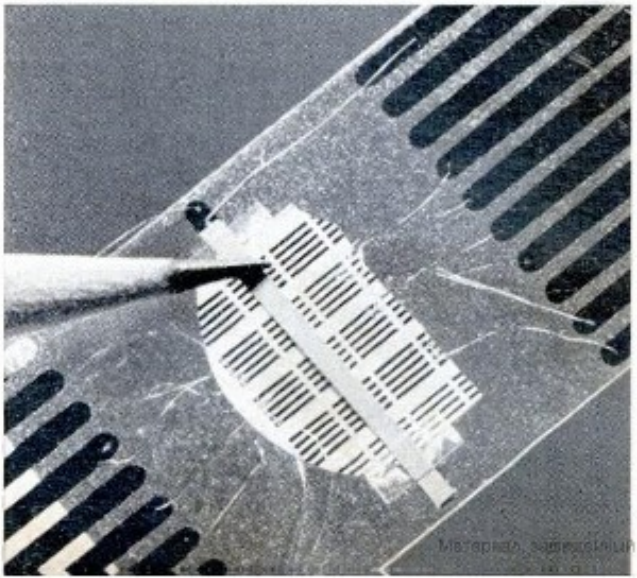
Tiny color cells are visible in this experimental color filter devised by Sandia Laboratories. Filter can "strain" any desired color out of white light electronically, change color at will.



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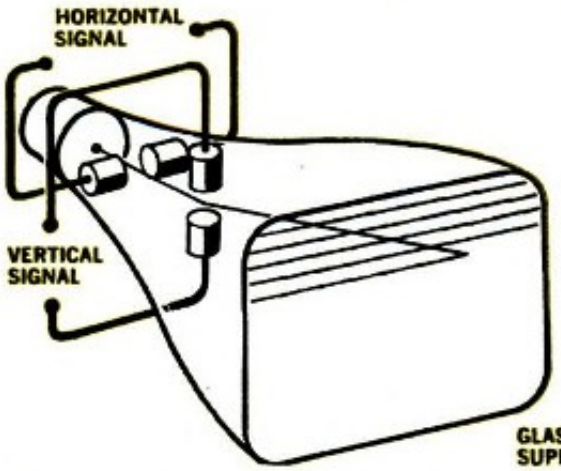
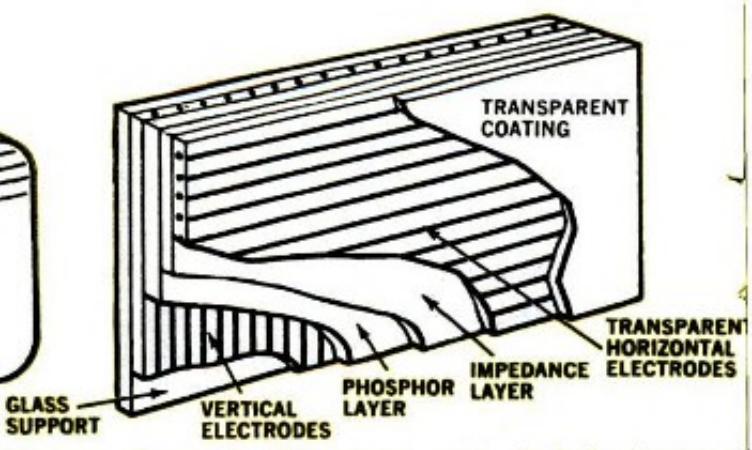
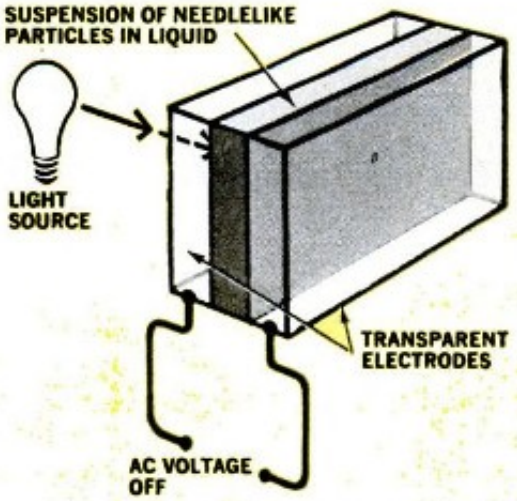
Which system will replace the picture tube?

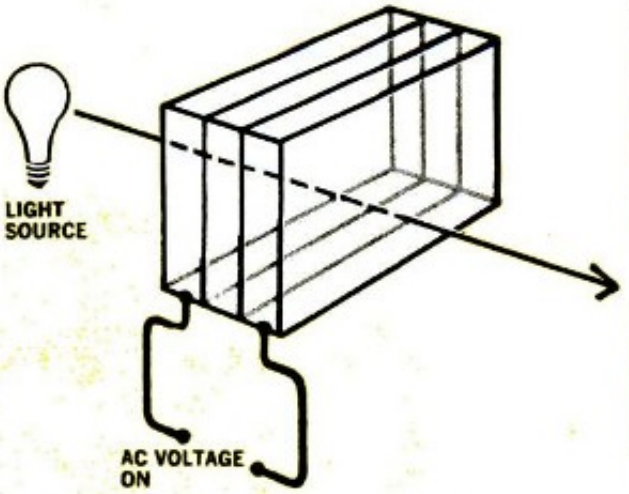


In the conventional cathode-ray picture tube, or CRT, a beam of electrons sweeps out the picture on a fluorescent screen. Electromagnetic coils control beam's direction, so it "addresses" correct spot on screen. Lines on screen are scanned so fast that your eye perceives complete picture all the time.



Panasonic flat screen uses electroluminescence. Voltage applied across any vertical and horizontal electrode pair will light EL phosphor at intersection. Actually, picture is addressed a row at a time and not spot by spot, as in CRT. Impedance layer in sandwich gives clean switching of picture elements.





The Varad system, by Marks Polarized Corp., uses cells with opaque suspension of tiny, needle-like particles. If DC voltage is applied, needles align, permitting light to pass. Marks hasn't built a TV screen, but claims to have achieved the high switching speeds needed for a working flat-screen model.

the one desired row electrode connected. Unfortunately, without other measures, a significant voltage will appear across the elements that should be "off" in both the addressed row *and* in the other 299 rows; the cause is capacitive interaction. To prevent this, a blanking voltage is pulsed to the "off" rows, which to a large extent cancels out the capacitive effects.

Not bright enough—yet. The prototype Matsushita flat-screen set doesn't come up to the conventional picture tube's resolution and brightness, so it probably won't become a commercial reality in the very near future. The set did, however, become the first mural TV far enough along to justify a public showing and give us an inkling of what's to come.

Close on its heels, another entry from across the Pacific was unveiled, this time by Mitsubishi Electric. The Mitsubishi screen is only about three by four inches, with a bare 80 lines. Obviously, its resolution is respectable only for a laboratory device; it also suffers from inadequate brightness. Like the Matsushita display, it uses an EL array, and a similar crossed-electrode grid, or x, y addressing scheme. The details of its workings are still safe in Tokyo.

We're in the race. Don't let all of this Japanese activity make you think that

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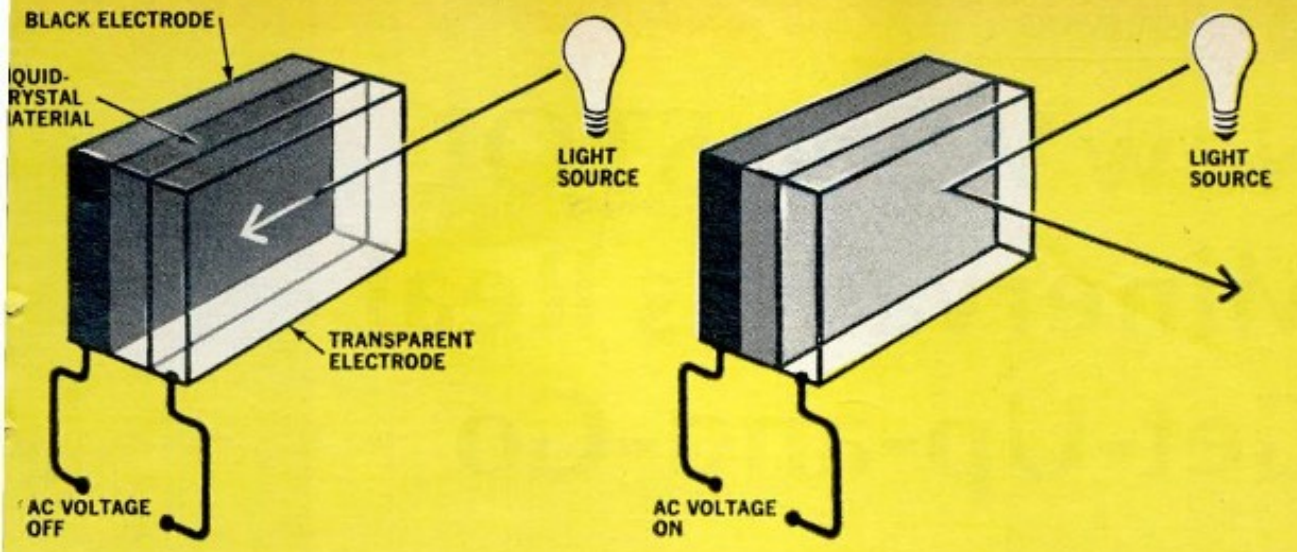
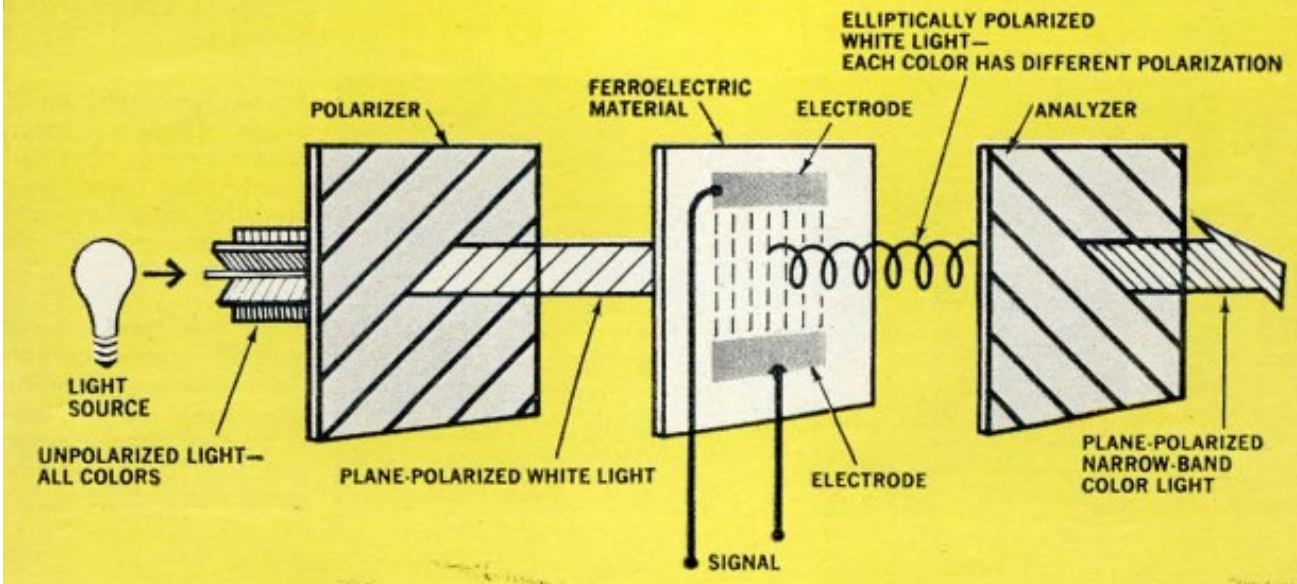


RCA's liquid-crystal display also uses crossed-electrode addressing grid. Drawing shows only one picture element. Before AC voltage is applied, light goes through liquid crystals and is absorbed by black electrode; after voltage is applied, liquid-crystal layer becomes white, reflects light.



How Sandia's color filter works: Polarizer passes only plane-polarized white light. A ferroelectric plate, controlled by electrical pulses, gives the desired color component of the white light just that specific polarization that will enable it to pass through the analyzer—a second polarizer.

there is an American "television gap." RCA has owned up to working on EL displays in their Princeton, N.J., laboratories, although they haven't shown an example of their efforts to the public. But they have recently been willing to talk about another one of their approaches to mural TV: "dynamic scattering" from liquid crystals.

Liquid crystals are materials that have some properties of both liquids and solids. The liquid crystals that RCA is using have a particularly interesting property—normally transparent, they become turbulent and cloudily opaque when an AC voltage is applied across them.

The liquid-crystal system. As in the case of EL displays, liquid crystals are used in a sandwich arrangement between two electrodes. Here again the electrodes for an array of cells are connected in a crossed grid of vertical columns and horizontal rows. A dark background is visible through the clear cells. When a voltage is put across any cell, it clouds up and reflects room light or sunlight. The screen does not supply any light at all; it simply controls the reflection of outside light to form a picture.

Thus the term "dynamic scattering"—the light is scattered; "dynamic" refers to

[*Continued on page 192*]

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EVR —Canned Movies from Your TV Set

Electronic Video Recording is the latest technological breakthrough for education and home entertainment

By SAM SHATAVSKY / *Electronics Editor*

A complete audio-visual entertainment and educational center in your home—that's what is coming with the introduction of CBS's new electronic video-recording system (EVR). Just as a long-playing record stores sound conveniently and inexpensively for later replay on a record player, EVR stores pictures and sound on a reel of film for playback through a standard television set.

Nothing like videotape recording. EVR uses electron-beam image recording on film to generate extremely small picture frames identical with those on movie film. The film is for playback only; you will not be able to make your own recordings, but will buy ready-made program reels produced by CBS and its licensees. Any motion picture, video-

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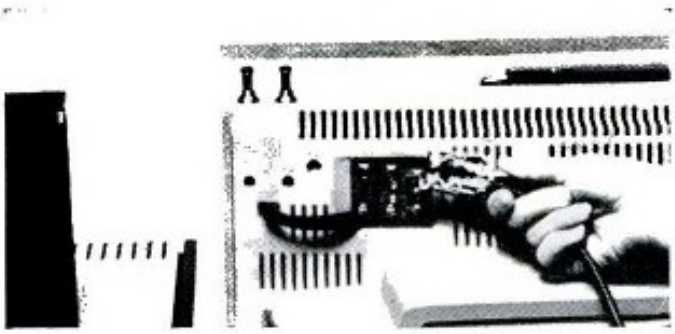

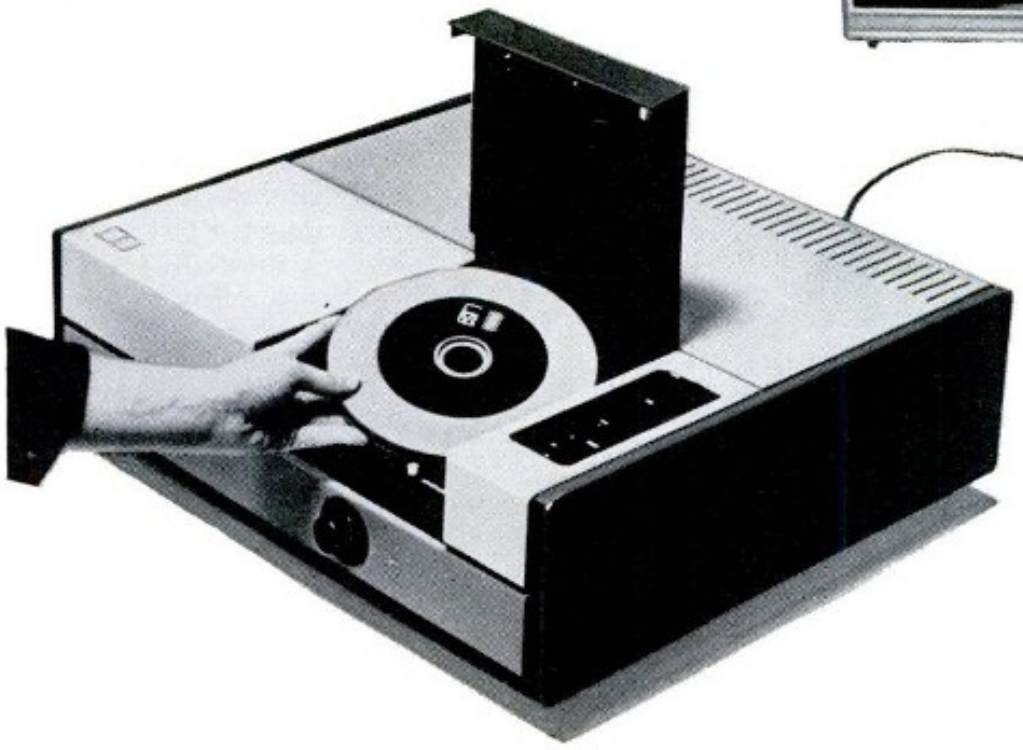

EVR player is compact and simple to operate. Twin leads from player are clipped onto TV set's antenna terminals. After film cartridge (about size of a magnetic-tape reel) is placed on spindle, player starts with push of a button. Playing time is 52 minutes for each seven-inch reel. There are controls for fast-forward, rewind, slow-scan, and stop-motion display of any picture frame.

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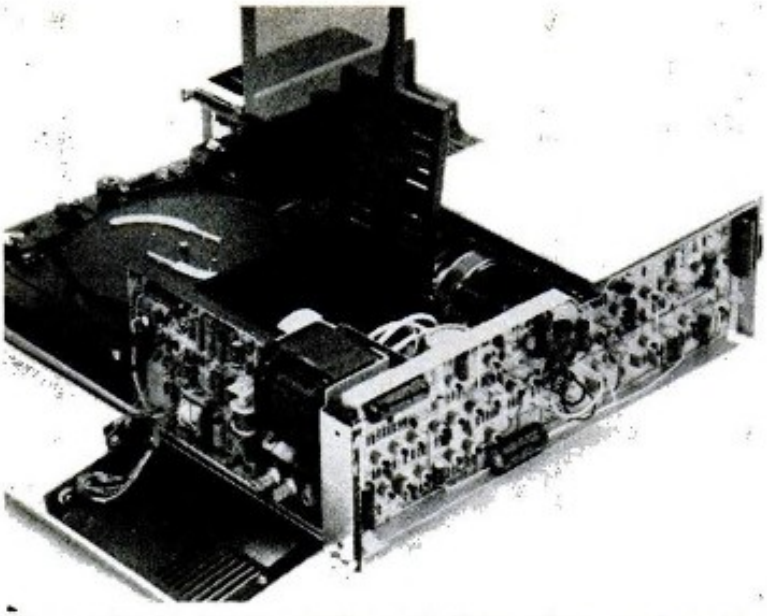

Player chassis houses electro-optical transducer system: the flying-spot scanner, photomultiplier, and electronic circuits, together with automatic-threading film-transport mechanism.

Thin film is dual-tracked and carries magnetic sound tracks on outer edges. Synchronized-light windows allow speed control without sprocket holes. Picture frame is ⅛ by 1/10 inch.

In classrooms, EVR is expected to play leading role, providing selected programing at teachers' discretion and convenience. Students will also operate easy-to-use players in learning labs.

tape, or live television program can be commercially recorded for EVR playback.

The whole family benefits. An EVR cartridge is about the size of an ordinary seven-inch magnetic-tape reel. By simply inserting one into the playback machine, Dad can sit at his TV set for an evening of golf lessons. Junior can bone up for a science exam with cartridges from the public library. Mother can take homemaking, bridge, or language courses. For entertainment, you'll have a choice of the latest movies, plays, and concerts. This will all come through your TV screen via the EVR player.

Because this new video recording system has a horizontal resolving power of up to 600 TV lines per picture frame, without interlace, picture quality is excellent.

EVR is also superior to magnetic videotape because of its high-speed low-cost duplication and the low cost of the film. It is predicted that cartridges will sell at the same price level as records with about the same playing time. Low film speed (six inches per second) gives fewer transport-mechanism problems—another advantage over the high-speed videotape machines.

CBS is setting up a plant for high-speed duplication and will develop the EVR market through the television, publishing, and motion-picture industries. In license agreements with CBS, Motorola will manufacture EVR players and the New York *Times* will develop educational EVR cartridges.

Although introduced in black-and-white, EVR will ultimately go to color. The initial price of a player is estimated at $800, but without question, this new sight-and-sound recording and playback system promises to open new doors to gaining knowledge and enjoying entertainment at home. PS

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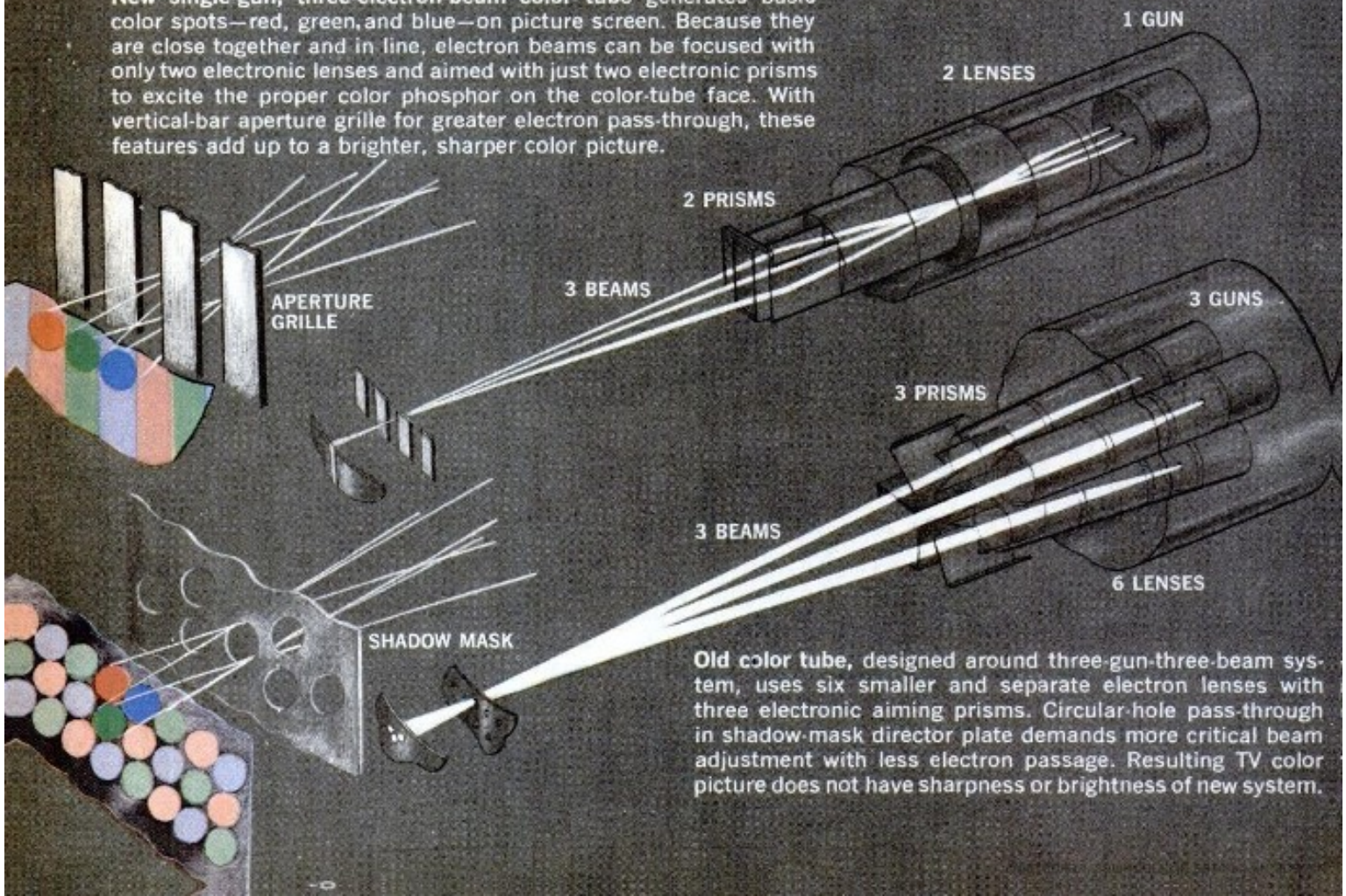
New TV Color Tube Gives Brighter, Sharper Pictures

New single-gun, three-electron-beam color tube generates basic color spots—red, green, and blue—on picture screen. Because they are close together and in line, electron beams can be focused with only two electronic lenses and aimed with just two electronic prisms to excite the proper color phosphor on the color-tube face. With vertical-bar aperture grille for greater electron pass-through, these features add up to a brighter, sharper color picture.



Old color tube, designed around three-gun-three-beam system, uses six smaller and separate electron lenses with three electronic aiming prisms. Circular-hole pass-through in shadow-mask director plate demands more critical beam adjustment with less electron passage. Resulting TV color picture does not have sharpness or brightness of new system.

Color TV takes a giant step forward with this new single-gun picture tube. It will give you a higher-quality, smaller-size, simpler-circuit color set—and should reduce maintenance

By **SAM SHATAVSKY** / *PS Electronics Editor*

One electron gun in this new color-TV tube does the job of the three guns used in the standard color-receiver system to emit three electron beams. Each of these beams excites and lights up the appropriate red-, green-, or blue-producing phosphor on the tube face to generate the color image.

Developed by the Sony Corporation, the new tube, called Trinitron, claims some significant advantages:

- Brighter, sharper color picture with greater contrast.
- Simplified picture-tube construction in smaller space.
- Less-complex circuits with fewer chassis components.
- Easier picture adjustment in fewer steps.
- Reduced size and weight of set.

There is no mystery to the generation of three beams from a single gun. Sony's engineers have simply combined three individual beam-producing tube cathodes into one integrated gun structure. It's like combining three single-barrel shotguns into a triple-barrel gun.

The assembly of such a unit is something else. It's critical. But apparently Sony has mastered it.

To understand how the color tube does its job, you can think of it as you would an optical system. Just as optical systems depend on lenses and prisms to focus and direct light beams, so the color-TV picture tube relies on electronic lenses and electronic prisms to steer its three electron beams to the right color phosphor on the tube's viewing face.

The three beams from one gun have been lined up much closer together than separate beams from three guns. This permits the use of two large electronic lenses instead of six smaller ones. Since large lenses intercept a greater portion of the electron beam and have a more uniform beam-focusing field, this new color-tube system yields a brighter and sharper color picture.

Besides that, the Trinitron's three beams are in an in-line, instead of triangular, arrangement. This simplifies tube-convergence adjustments—the process of directing the three color-producing beams to the same focal position at the viewing screen. In-line beams need only two adjustments compared with 12 in the old three-gun color tube. That should reduce TV service calls you have to make for convergence alignment.

Another Sony improvement is a new mask system, the Aperture Grill. The mask in a color tube is the color-selecting plate directly behind the tube's color-phosphor-coated viewing face. The new mask is a metal plate formed into vertical bars corresponding to vertical color-phosphor lines on the viewing-screen surface. (The old shadow mask uses a hole-perforated plate lined up with color-phosphor dots.) The Aperture Grill arrangement gives 30-percent more electron-beam transparency than a shadow mask, for a brighter color picture.

With these two breakthroughs, some spectacular color viewing is in store for this spring when Sony begins to ship sets equipped with the new tube.

Single-gun color tube (right) has smaller neck diameter with smaller wraparound sweep coil. It gives greater beam-sweep sensitivity, takes less power, and reduces the size and weight of the color set.

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Popular Science

The What's New magazine ®

Here at last: VIDEO-DISC PLAYERS

Strange world of SUPERPRESSURE

SECRETS OF SHARPENING

BIG BOATING SECTION:
- Ski-hull boat
- Windsurfing thrills
- Kevlar replace fiberglass?
- '77 outboards
- Hot cats
- Cuddy cabins
- Marine CB

ICE-BLOCK HOUSE cools with winter heat

TV PICTURE SIMULATED

Here at last–
video-disc players

Two disc machines that let you program your own shows will be introduced in '77

By JOHN FREE

Sometime this year, TV viewers in selected areas of the country should be able to schedule their own shows in an entirely new way. They'll select movies, musical performances, or other material on video discs, slip the discs into players wired to their receiver's antenna terminals, and push a button to watch the show.

A long list of glittering new video players has been promised, postponed, or introduced in recent years, only to fade from sight. But there are definite signs that at least two major worldwide organizations with the financial muscle and marketing know-how to succeed will begin selling their video-disc players regionally in 1977.

One of them, RCA, is already field-testing a few hundred of its capacitance-sensing SelectaVision disc players. N.V. Philips, the Dutch firm that brought us the standard audio cassette, and MCA Inc., an American entertainment-oriented firm, also plan to offer an optical video-disc system this year.

The latest price estimates: about $500 for the player, and $10 to $18 for a disc or set of discs.

There's even a possibility that a Japanese licensee of a British and German disc venture, the grooved-disc TED system [PS, Nov. '74], could be marketing disc players, too. Players for 10-minute TED discs have been available in Germany since 1975, although only for European TV-signal standards. Sales have been poor. A TED changer that handles 12 discs was recently shown. Spinning on the sidelines are other disc systems still under development [see box: "In the labs: machines that record and play discs"].

A technician slides a SelectaVision video-disc player into its outer cover at RCA's new plant in Indianapolis.

Both the RCA and Philips/MCA players will appear in stores just when new home video-cassette recorders [PS, Dec. '75], video games [PS, Nov. '76], and pay-cable programming are teaching viewers that their TV receivers can easily display something other than fixed-time broadcast fare.

What's different about the new disc hardware and programming? After operating both the RCA and Philips/MCA players, trying some amazing manipulations of TV images, and listening to stereo hi-fi TV sound I found that the new machines offer spectacular gains in performance compared with other home program sources.

Stamping out tons of discs at low cost is the biggest advantage of the new medium. Both Philips/MCA and RCA expect to offer a broad selection of discs when their players appear. MCA, which will manufacture most U.S. discs for the Mag-

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navox-built player, plans 1000 albums initially.

MCA discs will include new and old films, ballet, opera, theater, sports, how-to and children's programs, and documentaries. MCA can also make a thin flexible disc that might be inserted in periodicals. Discs may also be distributed as entire magazines, catalogs, or talking encyclopedias.

Also, a variety of independent companies will add other special-interest discs to catalogs. One firm, Visiondisc Corp. of New York, for example, planned to tape last year's Christmas services and works of art at a large cathedral for transfer to discs.

Here's how the two leading players and disc formats differ:

RCA's SelectaVision

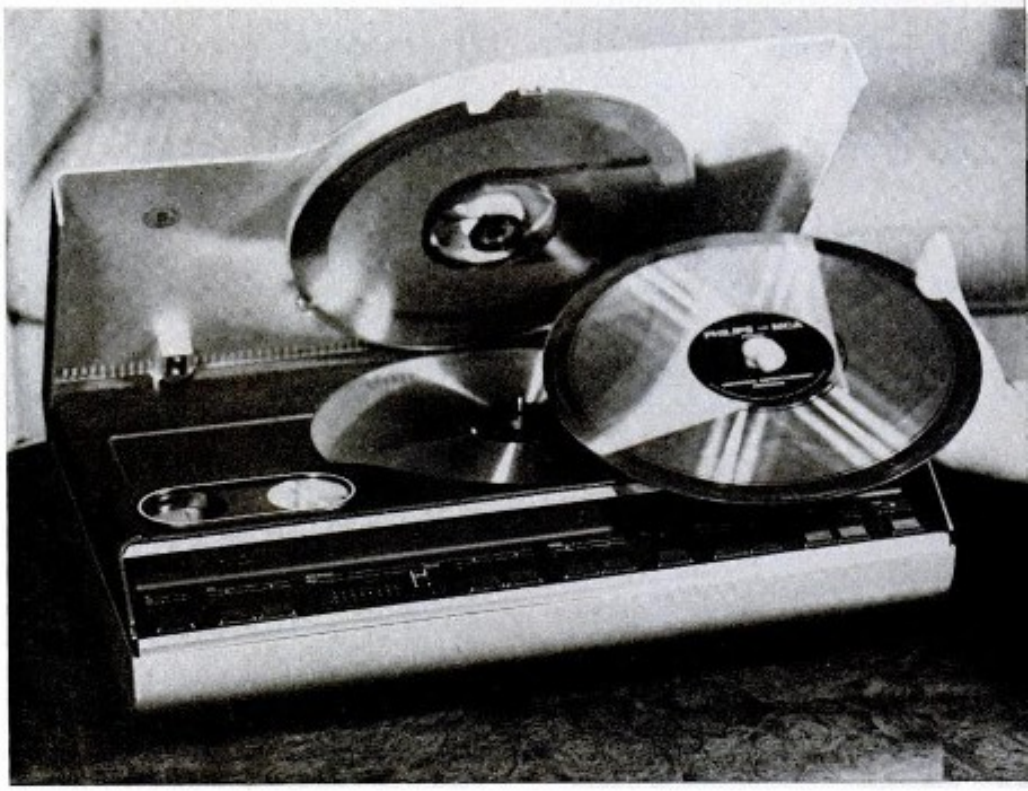
This machine is designed to play a rigid, grooved disc 12 inches in diameter and programmed on both sides with 30 minutes of material. The function of the spiral groove is to guide a stylus, much as in an audio-disc system.

But that's the end of any similarity to familiar 33-1/3- or 45-rpm discs. The SelectaVision player, which won't operate unless the lid is closed, spins discs at 450 rpm. TV signals are encoded as minute rectangular depressions at the bottom of each groove. The slots vary in spacing and width, with some as narrow as 0.25 microns (millionths of a meter). RCA devised a method of producing the slots on a disc master, using a sharply focused electron beam, since required widths are too narrow to be generated optically with light. The discs have a vinyl base topped with thin layers of metal, an insulating plastic (dielectric), and an oil lubricant that reduces stylus wear.

Together, the disc and metal-tipped stylus form an electrical circuit. As the slots spin past the stylus, tiny abrupt changes in circuit capacitance occur. These changes detune an oscillator circuit to produce the TV signal.

To compensate for small changes in rotational speed, a tiny transducer, which functions somewhat like a loudspeaker coil and cone, stretches the stylus arm back and forth parallel to the groove. Errors in speed are detected by monitoring the recorded color-burst signal.

A close look at a SelectaVision player confirms RCA's disc-system-design philosphy. Components are housed in a simple, inexpensive cabinet with a minimum number of controls. Internal circuit boards and components, prominently displayed on a pegboard in RCA's New York demonstration room, remind you of a Heathkit spread out for assembly. RCA deliberately designed a player that could be easily mass-produced with relatively standard parts.



Care is necessary when loading discs in the machine, since fingerprints or smudges can create interference. Playing discs repeatedly through can remove contaminants from the grooves, but since the $15 stylus must be replaced after 200 to 300 hours of use, it's wiser to take good care of records. Each disc can be played about 500 times.

Pictures I've seen at several demonstrations were excellent. You can rapidly move the tangential stylus arm forward or backward to selected disc areas by pushing buttons; a lighted index on the panel becomes larger or smaller. A pause button breaks stylus contact. The player has two audio channels for stereo or bilingual programming, and audio output jacks for optional connection to a hi-fi amplifier.

Philips/MCA player

This concept differs radically from SelectaVision. Only the center spindle touches Philips/MCA discs as they spin at 1800 rpm. An air bearing that develops at that speed aids stabilization. A low-power laser

[*Continued on page 140*]

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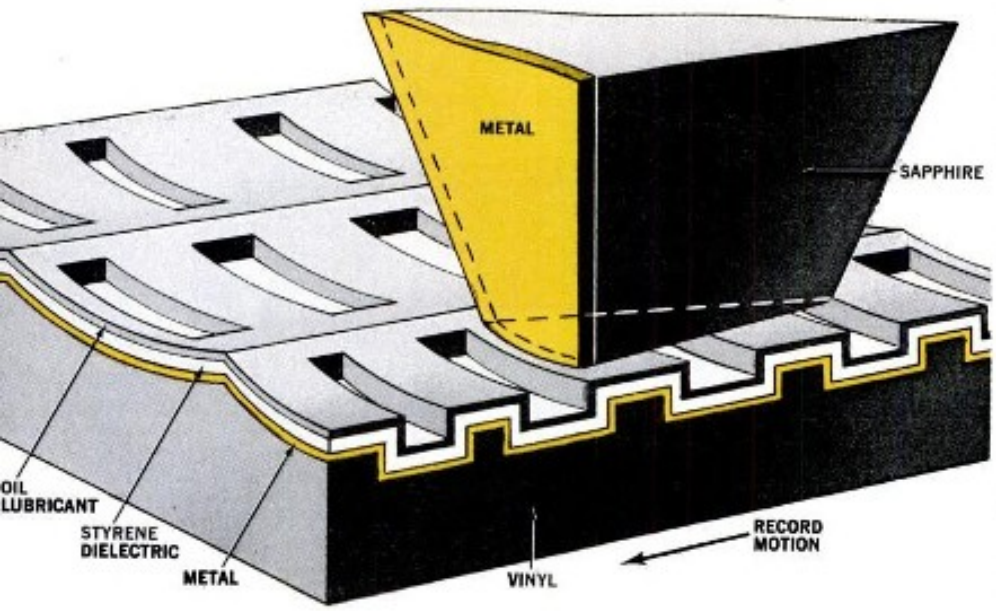
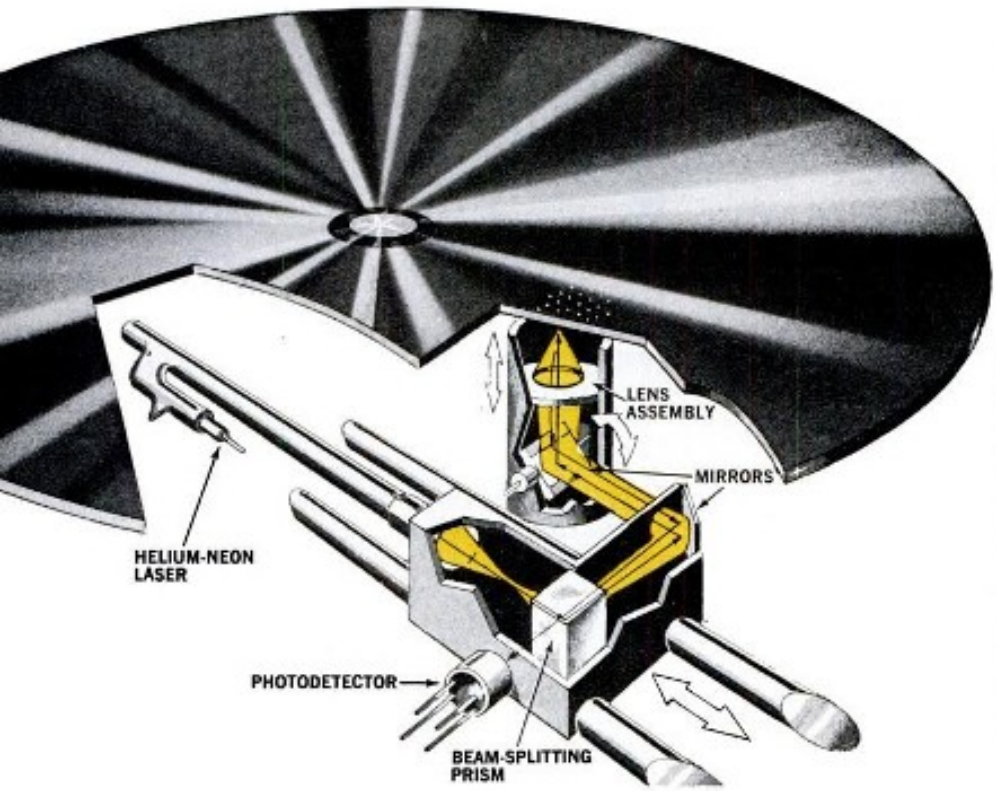


A stylus that detects picture signals in grooves

RCA SelectaVision player (far left) spins rigid 0.07-inch-thick discs at 450 rpm. Discs carry 30 minutes of material on each side. TV signals are detected by a metal-tipped sapphire stylus tracking at about 50 milligrams in a spiral groove. Picture information is recorded on discs as microscopic slots of different width and separation. The metallic stylus senses a change of electrical capacitance as the slots spin beneath it. This capacitance variation changes an electronic signal that is unscrambled into TV pictures. Metallic and dielectric coatings necessary for playback give SelectaVision discs a shiny appearance. There are 5555 grooves per inch, and each circular groove stores four 1/30-second TV frames. The player has fast-forward and reverse buttons for cueing.



Laser-beam system decodes a spiral track of bumps

Philips/MCA optical video-disc player (far left), manufactured by Magnavox, rotates discs at 1800 rpm. Players can handle either rigid 0.04-inch-thick discs, or, with an adapter, 0.007-inch flexible versions. Nothing contacts the disc for picture readout: A laser beam is focused through a mirror/lens system onto a spiral track of bumps on the bottom of the disc. Spacing between the bumps varies according to TV picture information. The bumps scatter the beam, but the flat, shiny aluminum area between them reflects light back through a two-way prism or mirror to a photodiode detector. The detector circuits convert the code-like flashes from the disc into a TV signal. Tracks are less than two microns (millionths of a meter) apart. The player can endlessly freeze a TV frame, show fast or slow-motion pictures, and display on the screen the number of up to 54,000 separate coded frames. Discs hold 30 minutes of programming on one side only.

In the labs: machines that record and play discs

As the big contenders (RCA, N.V. Philips, and MCA, Inc.), gear up production lines to produce capacitance and optical video-disc systems (diagrams above), other companies and institutions are busy refining other ingenious disc systems in laboratories. Although developers of new players frequently say they plan to market them, the huge expense of manufacturing and distributing a major new product today may prevent you from ever seeing most new systems in stores. Some of these disc systems are intriguing because they can record TV programs as well as play prerecorded discs:

● A magnetic disc recorder (MDR) has been under development for several years by Erich Rabe, a German record manufacturer [PS, Nov. '74]. The latest version, demonstrated last year in Europe, presented poor color pictures. Meanwhile, a U.S. licensee, TV Disc Corp. in Waltham, Mass., is developing its version of MDR. The Rabe recorder/player, similar in appearance to an audio turntable, has a tone-arm-mounted recording head that rides in the grooves of the magnetic disc. The head can record 24 tracks in the groove walls, and might provide two-hour discs. Early 12-inch discs of this type played at a slow 156 rpm.

● Another disc-recorder system, developed by University of Toronto professor John Locke and a graduate student, encodes TV signals onto a specially formulated plastic with a low-power laser beam. Locke told the trade weekly, *Television Digest*, that he expects a home video-disc recorder would use a dual-power laser. The higher-power beam—perhaps only two milliwatts, or twice that of the Philips/MCA readout laser—would record, and the low-power beam would play back. Locke says he is in touch with potential manufacturers.

● In Japan, Hitachi Ltd. has developed a holographic video disc (playback only) that eliminates the complex focusing and tracking devices used in other optical systems. (Holograms are photographic images made with laser light.) The disc system, described in the June,1976, *Applied Optics*, employs a continuous train of one-millimeter-square holograms on the disc's surface. Each hologram is actually three separate images (for brightness, color, and sound) offset 120° from each other. The disc rotates at only six rpm.

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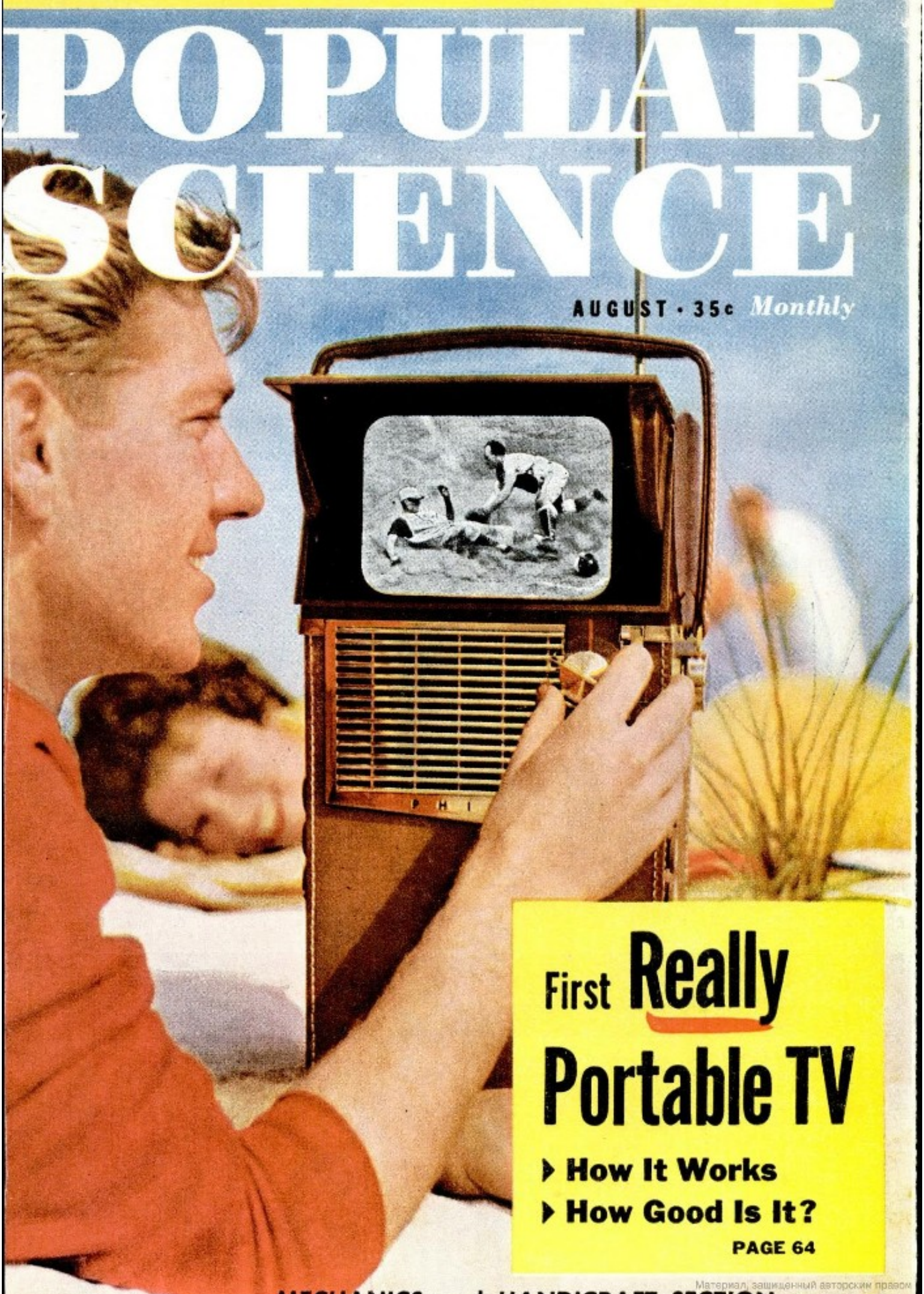
How Much Can You Save With a Small Car? PAGE 78

POPULAR SCIENCE

AUGUST · 35c *Monthly*



First **Really Portable TV**

- How It Works
- How Good Is It?

PAGE 64

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MECHANICS and HANDICRAFT SECTION PAGE 121

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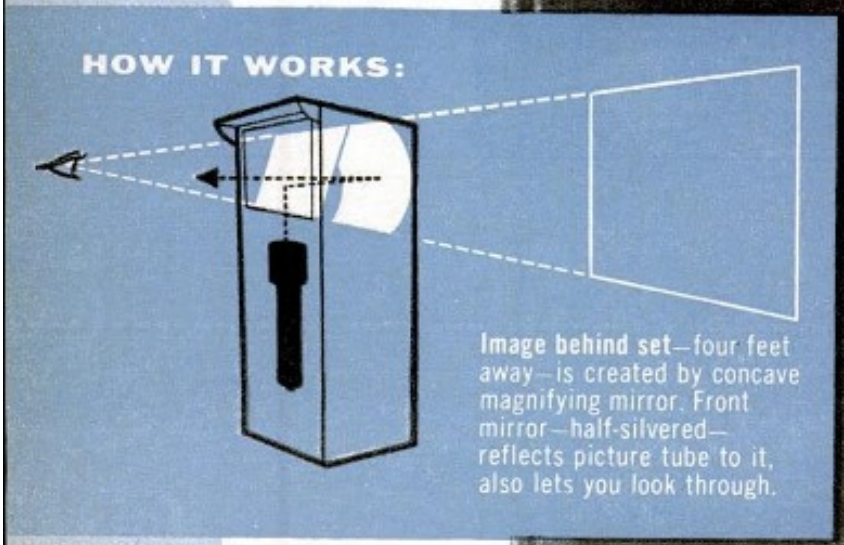
First Really

Here is battery-powered television in a small, transistor receiver to take—and use—wherever you go

By Martin Mann

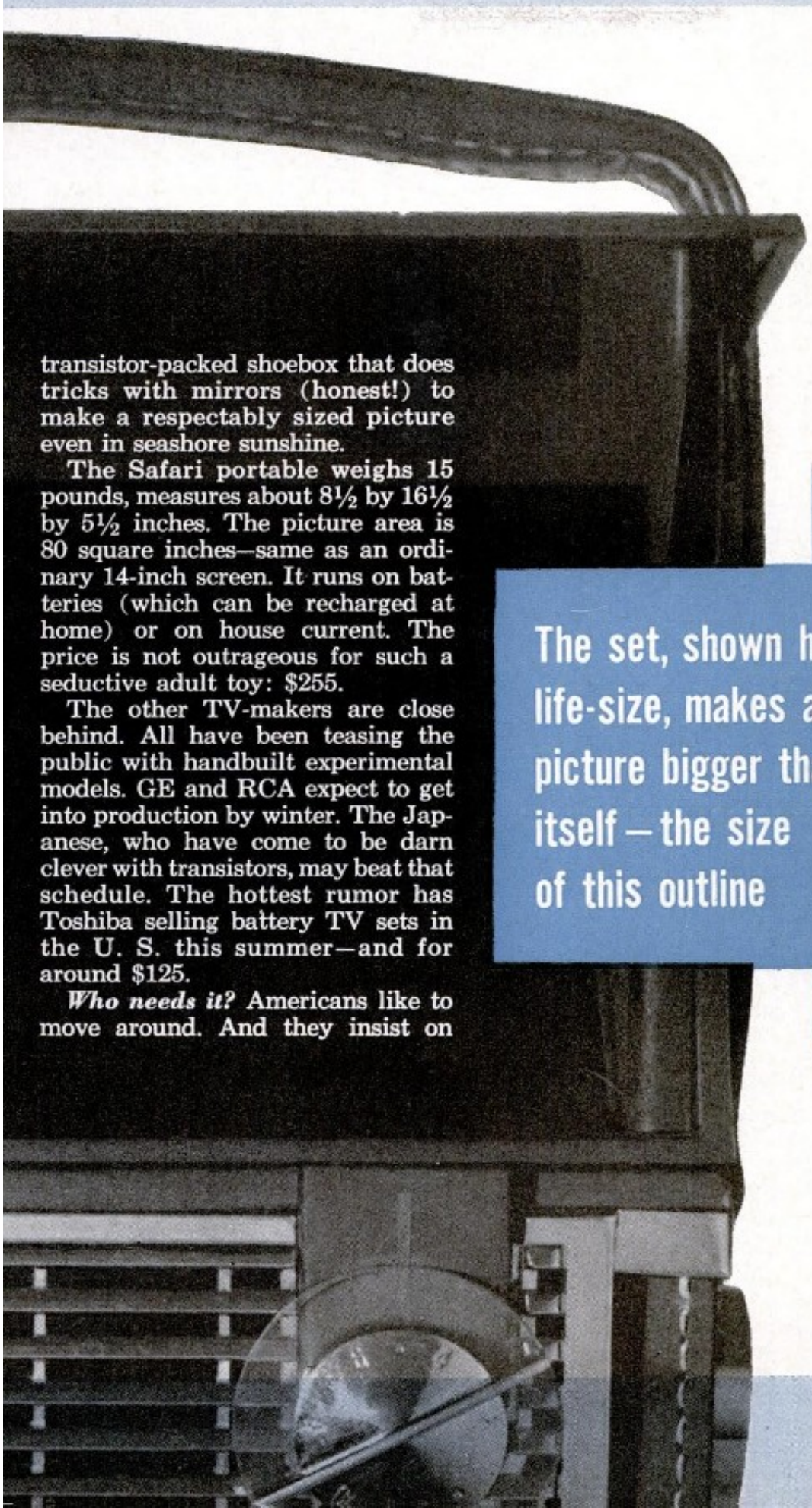


NOW they've gone and done it. They've built a TV set you can take with you: a genuine portable—battery-powered. You no longer need a power cord, or an outlet to plug it into.

It works just about anywhere except under water. You can go to the beach without missing the ball game, enjoy Lawrence Welk from a canoe, catch Jack Paar while camping out or, more practically, keep a child quiet in the back seat on an auto trip.

Philco is first, by virtue of remarkably imaginative engineering. Its production lines are now stamping out the Safari, a leather-covered,

Portable TV



transistor-packed shoebox that does tricks with mirrors (honest!) to make a respectably sized picture even in seashore sunshine.

The Safari portable weighs 15 pounds, measures about 8½ by 16½ by 5½ inches. The picture area is 80 square inches—same as an ordinary 14-inch screen. It runs on batteries (which can be recharged at home) or on house current. The price is not outrageous for such a seductive adult toy: $255.

The other TV-makers are close behind. All have been teasing the public with handbuilt experimental models. GE and RCA expect to get into production by winter. The Japanese, who have come to be darn clever with transistors, may beat that schedule. The hottest rumor has Toshiba selling battery TV sets in the U. S. this summer—and for around $125.

Who needs it? Americans like to move around. And they insist on

The set, shown here life-size, makes a picture bigger than itself—the size of this outline

CONTINUED

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Mirrors turn the trick: From small tube, cheap battery, they make a big picture you can watch in bright sun

taking their entertainment with them—the magazine rolled into a pocket, the portable radio held at ear level.

Carry-along TV is a natural addition. Even at home, it's a convenience: You can take it out into the back yard, or simply move it from room to room without crawling around stabbing at an outlet.

But the manufacturer's motive for gambling a million or so on such a new product can be considerably more complex. He may hope that (a) people will buy the gadget because it is a Practical and Useful Convenience; or (b) people may not need the gadget but will buy anyway because it is The Thing to Do, like dancing the cha-cha-cha; or (c) people will come into the store to see the Amazing New Invention and end up buying something else he wants to sell, as they look at convertibles and buy sedans.

What's so difficult? All the big electronics labs have had orders from above: Make us a salable transistor TV set. The resident geniuses failed to deliver, until now, for three very good reasons:

1. Picture tubes were too bulky, too heavy, and too hungry for electricity.
2. Batteries were too bulky, too heavy and too weak—unless very costly.
3. Transistors for the very high frequencies of television circuits were too expensive, mainly because they couldn't be manufactured uniformly.

Problem number three is in hand. Philco has geared up an automatic assembly system that cranks out transistors more than a third cheaper than before. Even so, a Safari contains 60-odd dollars' worth of transistors.

Recent developments in rechargeable batteries ("Clever New Gadgets Run on Flashlight Batteries," PS, March) ease the power bind somewhat, although hardly enough to suit the TV designers. They don't make batteries, and can afford to be unreasonable. The Philco set contains a package of five cells (labeled Philco but made by Eveready). It goes four hours between charges, can be recharged maybe 20 times, and costs around five bucks to replace when it's finally shot—about six cents an hour for power.

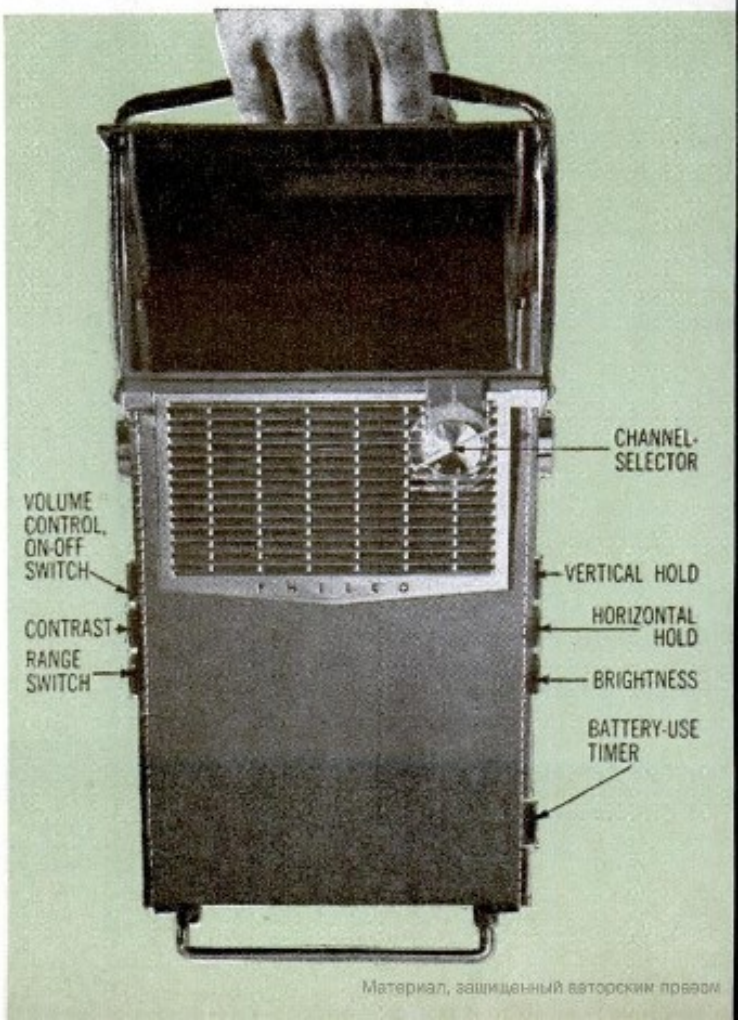
This is a pretty small battery. The portable TV set draws only 4½ watts—a living-room receiver draws 200. Philco gets away with it partly by prudent design (project engineer Al Curll remarks, "We wouldn't dream of adding a pilot light"), but mainly it's because of a unique solution to the picture-tube problem.

The ideal solution would be a solid picture tube, built like a transistor to operate on a trickle of power. So far this is still a gleam in the eyes of the long-hairs who practice quantum mechanics.

Philco finessed. The bright idea came to research v-p Dave Smith when he was flipping through that standard source of inspiration, the Sears, Roebuck catalogue. He saw Sears' slide viewer.

The slide viewer is a $10 optical gadget that shows you an enlarged image of a 35-mm. photo transparency when you hold it up to your eyes. The picture

COMPACT AND LIGHTWEIGHT, Philco's Safari is a bit larger than a shoebox, weighs 15 pounds. Most of bulk is accounted for by mirrors, picture tube and battery pack (opposite page). Transistor-studded boards form sides of chassis. Visor (shown up) shades viewing system, protects it when closed. Brass stand adjusts to tilt receiver for comfortable viewing angle.



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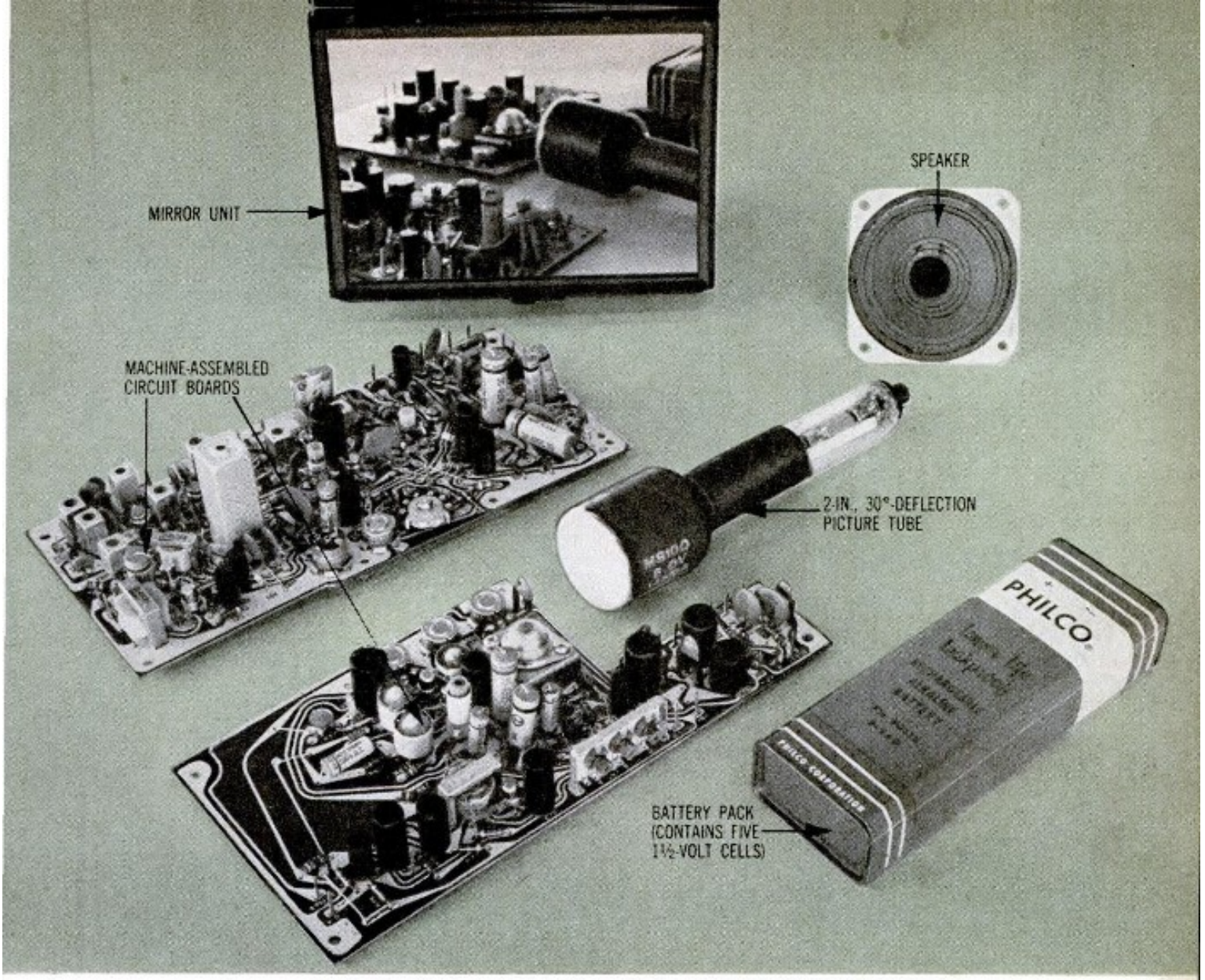

seems to float in space some distance behind the viewer. It is a "virtual" image, like the image of yourself you see when you look in an ordinary mirror—your reflection appears to be a person standing behind the mirror.

The same kind of optical system sits atop the Philco portable. It has a concave mirror to magnify the face of the picture tube. To see this magnified picture, your eyes focus on a point *four feet behind* the TV set. So the image you watch is large, and appears to be hanging in space behind the set.

And that's the secret. It means:

- You can use a very small picture tube—two-inch screen—with great savings in cost, bulk and weight.
- A small tube gets by on less electricity, so you save on batteries. The reason is that much of the power goes to swing the electron beam back and forth. A small tube can be built with a narrow swing (30 degrees instead of 110) without becoming impossibly long.
- Bright sunlight can't wash out the picture because you don't look at the tube face directly. The image you focus on is four feet behind the case, so you can stick your head right up under the little visor and watch in comfort.

Naturally, you don't get all this for nothing. The small tube has to be carefully made, precisely positioned and protected against dust. Otherwise, any defect will be magnified along with the picture.

More important, to see the picture at all you have to sit close to the set and squarely in front of it. If you move off the center line, the image slews out of sight. And this means just one person can watch. Two people can see only if they are on very, very friendly terms.

How good is it? Philco's engineers were ordered to produce a genuine portable. It

[*Continued on page 192*]

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Dollar-Saving Formula:

How to Figure When to Trade In Your Car

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New 2-Piece TV

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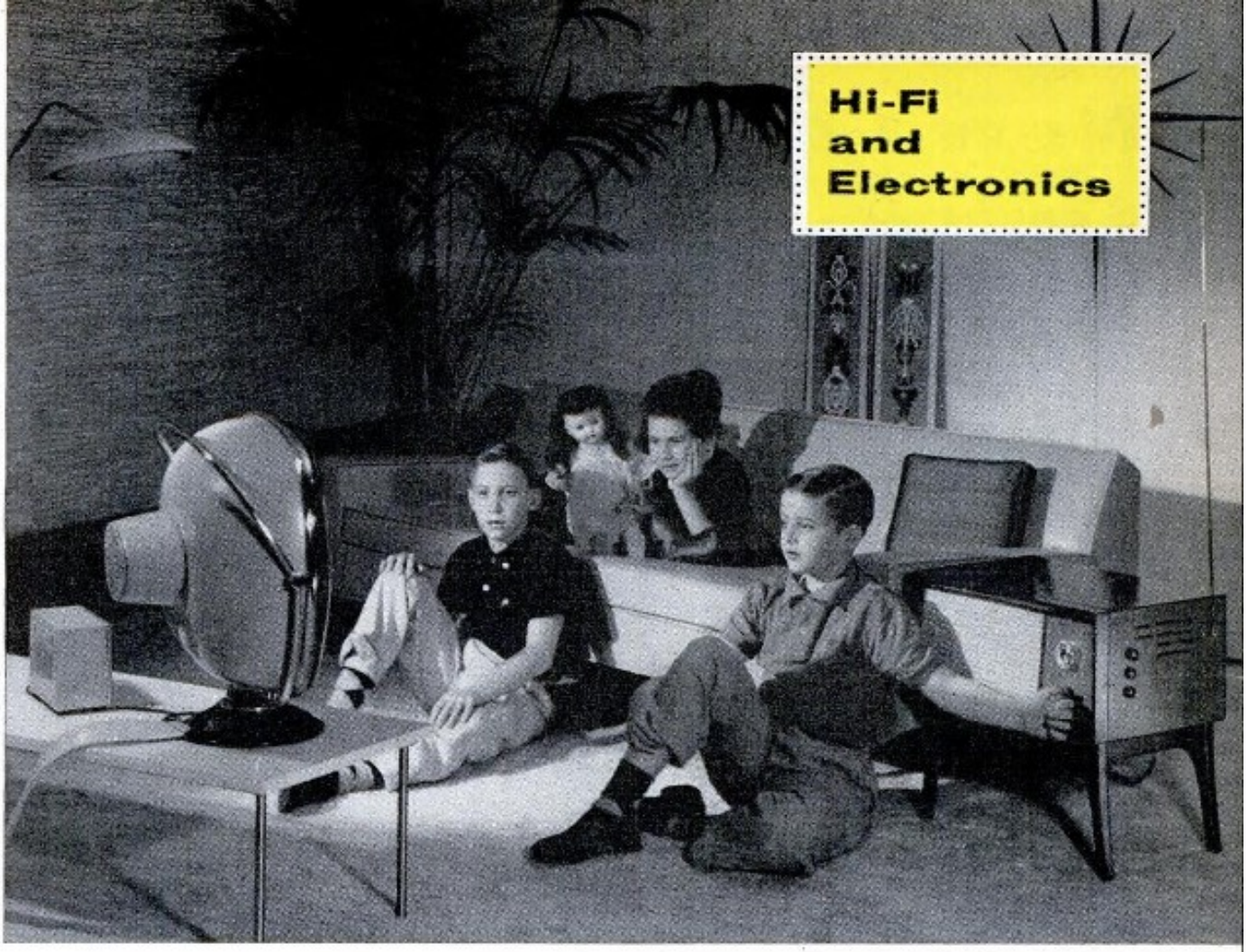

2-Piece TV Has Portable Picture Tube

Designers pluck the tube out of the cabinet and stand it by itself in Philco's '58 line

By Hubert Luckett

A MANUFACTURER of television sets has about as much chance of keeping a radical development secret as he would an elopement planned on a rural party line. The picture tube pretty much dictates the basic dimensions of any styling change. And all picture-tube envelopes come from the same supplier.

This was the problem facing the planners at Philco two years ago. They had been poring over statistics that pointed to a distinctly unhappy future for TV manufacturers.

The discouraging prospects appeared to be these:

- Just about everyone not still reading by a kerosene lamp would own a TV set by 1958.
- People were hanging on to their old sets. Customers who would sooner let their wives wear last year's fashions than drive a five-year-old car were still watching TV sets that had been bought six or seven years before.

Taking a disenchanted look at the sets introduced annually since the 21-inch tube became standard, Philco's market analysts made a surprising discovery: It was almost impossible to distinguish the latest models from those of three or four years back. Except for the larger tube face, the basic idea of a TV set had never changed—it was simply a box with a window in it.

The industry had failed to develop a re-

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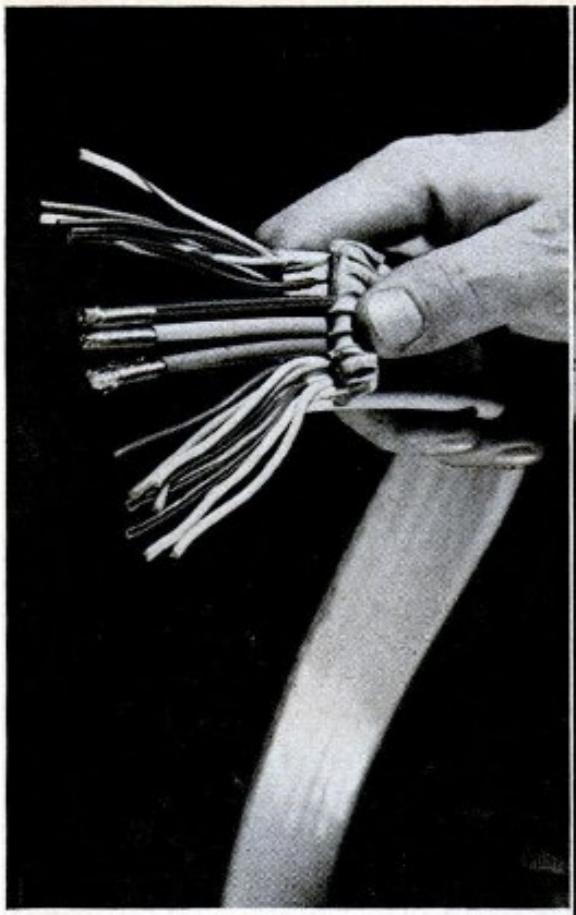

PICTURE PIPELINE: A fistful of conductors are molded in a flat ribbon of tough plastic to supply operating voltages and signal to the remote picture tube. Cable also carries sound signal so that an accessory speaker can be plugged into the base of the remote tube.

CHAIRSIDE TABLE holds chassis with controls and loudspeaker. Picture tube may be placed anywhere in the room within 25 feet. Connecting cable can go under the rug or around the baseboard.

placement market simply because it offered no compelling reason for the customers to give up their old sets.

Starting with this fresh insight (fresh to the manufacturers, that is; the customers obviously knew it all along), Philco launched a two-year program. They went along with the rest of the industry in '57, packaging the then new 110-degree picture tube [PS, Nov. '57] in the conventional box-with-a-window.

Meanwhile their designers worked overtime, racing the calendar to have their big dream ready for '58.

It soon began to appear that they were stymied. If they were to keep their secret —and a competitive advantage—they had to get along with the standard picture-tube envelope. But they needed a more compact tube to fit their plans for a showy new appearance in TV receivers. They licked the problem—not by a technical discovery—but by snipping away at the space required by the electron gun in the tube neck. They gained a full two inches. The needed alterations in the tube envelope could be done in the privacy of their own plant. The result, according to Philco engineers, is

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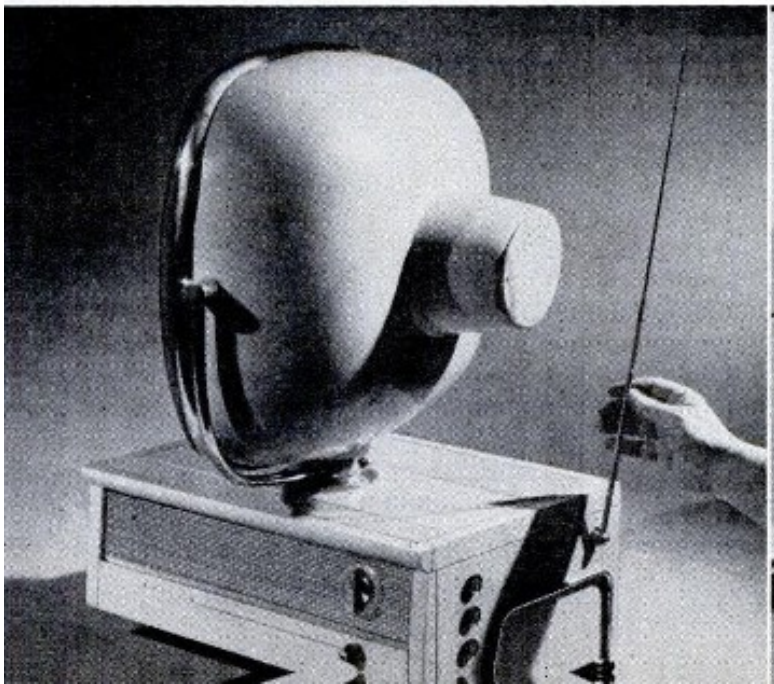
PICTURE TUBE IS ENCLOSED completely in a plastic capsule, swivel-mounted atop a pedestal base containing the chassis. An eight-inch speaker in the base gives you out-front sound.

COMPACT TABLE MODEL with swivel tube gives a full 21-inch picture, yet the package is small enough to be carried easily about the home.

TELESCOPING ANTENNA replaces the former unsightly "rabbit ears." It collapses and disappears inside the cabinet when not in use.



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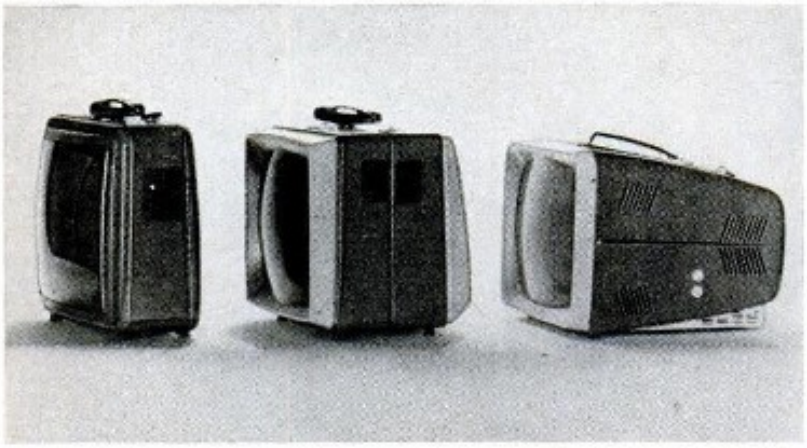
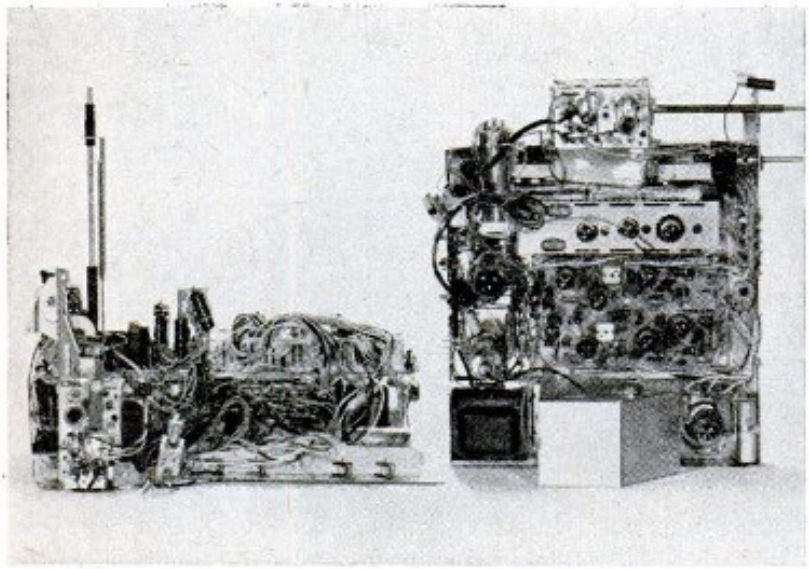
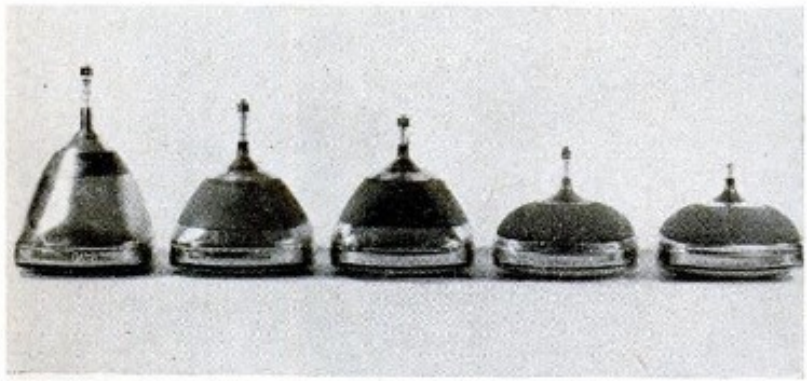
Not a picture-on-the-wall yet, but these sets go far in that direction



HERE'S WHAT HAS HAPPENED to portable television sets in only three years. On the left is the "Slender Seventeener," a 17-inch set made possible by the new, shorter picture tube. It has a built-in, rotating antenna that serves as the handle.



CHASSIS HAD TO BE SQUEEZED, too, to fit into the new windowless cabinet. On the left is all that remains after engineers had packed all the "works" contained in the standard chassis (right) into suitable form for the new sets.



SHORT HISTORY OF THE SHRINKING PICTURE TUBE: Line-up of 21-inch picture tubes used in the past eight years shows how the length has steadily decreased. Latest 110-degree Philco tube is a full two inches shorter than last year's.

the shortest 21-inch picture tube ever produced for the consumer market.

Here was a tube compact enough to be capsuled in plastic and given an independent role in the design of a TV set.

Three versions of separate screen television are the result: a table model and a pedestal model with the picture tube swivel-mounted on top, and a two-piece job that lets you put the picture anywhere you like while the chassis and controls stay within easy reach of your armchair.

The new sets will be easier to service than the old-fashioned kind, Philco claims. The chassis slides out of the back of the cabinet like a file drawer to make tube replacement or other servicing a breeze.

Laboratory tests indicate that the picture-tube mount provides a greater margin of safety against implosion (bursting inward—opposite of explosion) than the usual mount inside the cabinet. Stray radiation that might interfere with nearby receivers is claimed to be less than the FCC minimum requirements.

There was an unexpected bonus along with the new picture-tube package — the face of the tube doesn't get dirty. Because of high voltage, a tube face usually collects dirt the way glass on a penny-candy counter collects fingerprints. It needs frequent cleaning to give a bright picture, which usually means removing the chassis from the cabinet or at best removing the covering safety glass. But with the capsuled tube, the dirt collects on the outside of the plastic cover where it can be easily wiped off. END

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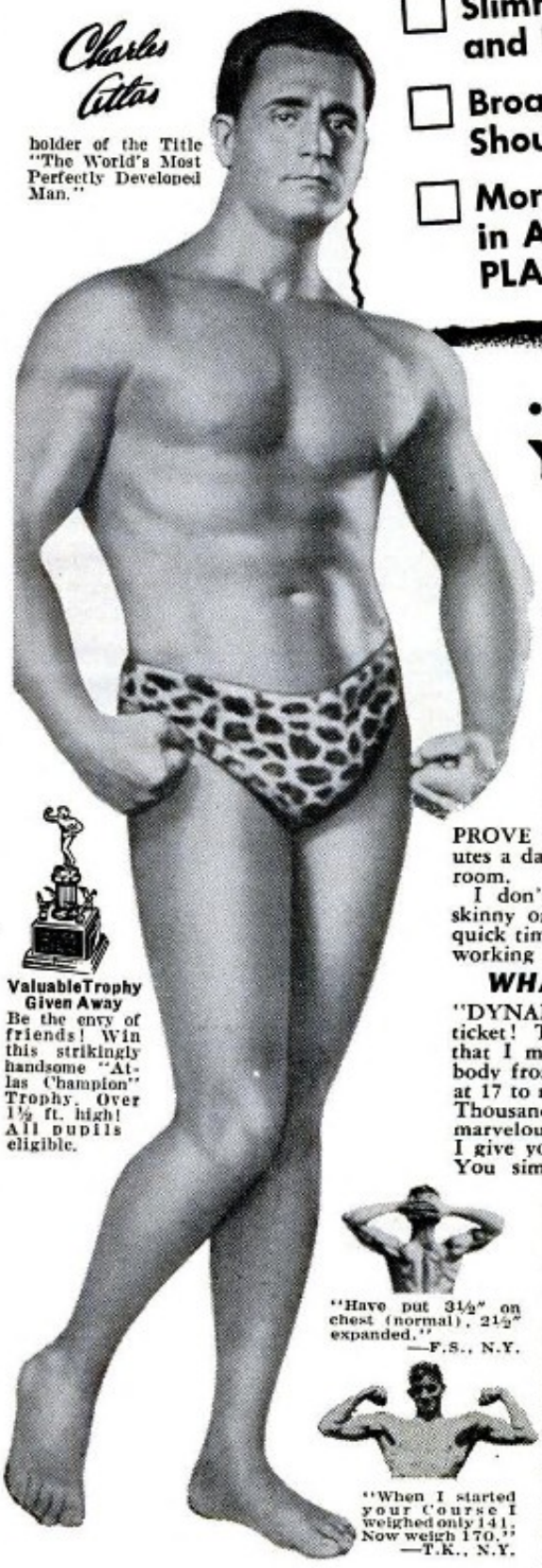

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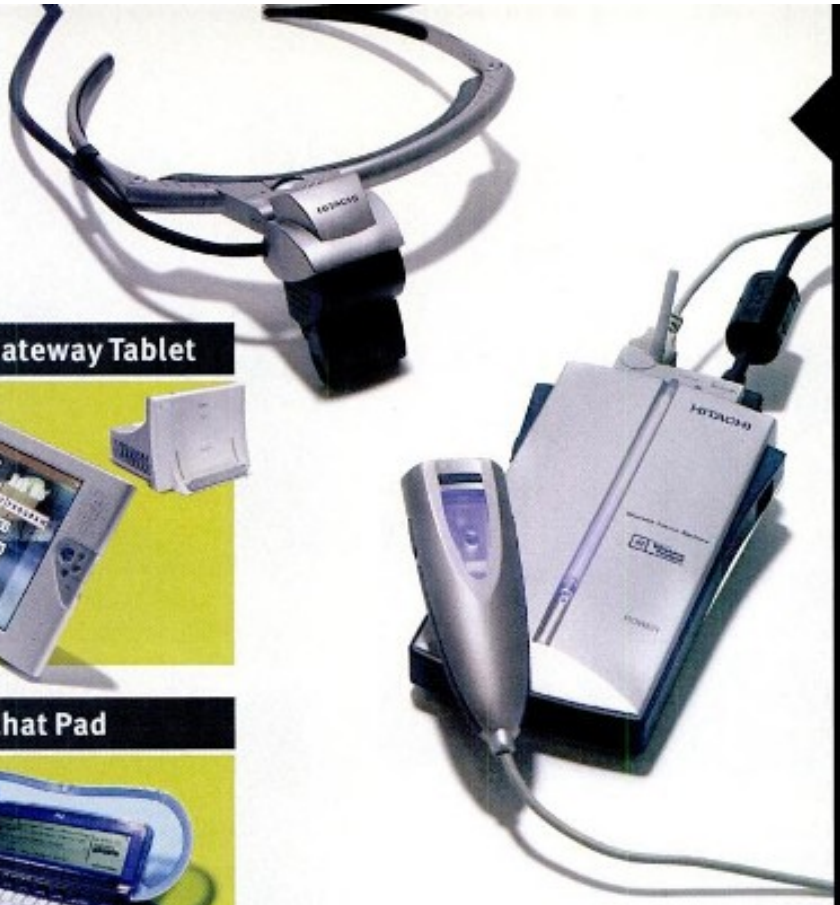
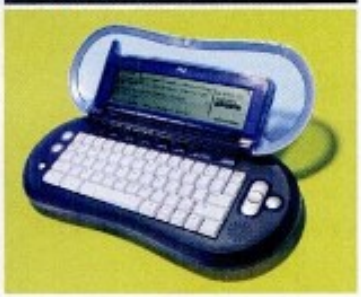


SONY Gateway Tablet

INTEL Chat Pad



Browse on the Go

IF YOU WEREN'T convinced before that the Internet is meant for on-the-go access, the sheer number of devices that now let you do exactly that might make you reconsider. Sony's Wireless AV/IT Gateway tablet-style display device not only offers Web and e-mail access, it also lets you watch TV, DVD movies, and video from any other source hooked up to its base station. For the kids in your family, Intel's prototype Chat Pad offers access to e-mail and chat via a 900MHz wireless transceiver attached to your PC. The Chat Pad makes use of the PC's capabilities while maintaining privacy. When you want to go more than 100 feet from your home, strap on Hitachi's Wearable Internet Appliance. The device (left) clips to your belt; you wear a head-mounted display (top). You navigate the screen via an optical thumb-controlled mouse.

Table Topper

WEIGHING IN at only 100 pounds, the 50-inch RCA L50000 HDTV is one of the first tabletop models of its size, thanks to its liquid crystal on silicon (LCOS) display. Instead of converging three images—red, green, and blue—on a mirror at the back of the rear projection TV, the LCOS display uses red, green, and blue light streams reflected off separate imaging panels and recombined in a prism to form a single video image.

Boom Box Backpack

PORTABLE doesn't mean personal with JVC's RS-WP1 Sports Portable Backpack boom box. This 20-watt system features four full-range speakers with an active Hyper Bass Pro II circuit to improve deep bass sound, a digital AM/FM tuner with 45 presets, and a CD player with a 40-second anti-shock protection. The $220 rugged Backpack is also weatherproof.

Disc Dreams

WHAT CAN YOU DO with DataPlay's quarter-size disc, which holds 500MB and costs just $10? A lot, judging from the scores of prototypes on display. A couple of the most promising were Volan Design's e-book, which features two displays—one to read the book, the other to browse the Web—and Varovision's Wings portable media player, which plays back MPEG-4 movies and MP3 audio files.

VOLAN DESIGN
Concept e-Book

Good Things Come in Small Packages

THE CHICKLET-SIZE SD card made a big splash this year, with many companies showing real and prototype products. Among the standouts were Toshiba's prototype desktop stereo system (lower far right) and Sharp's Zaurus MI-E1 PDA (right), which features MPEG-4 movie and MP3 music playback, Web browsing and e-mail, a 3.5-inch front-lit reflecting LCD, and 8MB RAM. Also on display were Panasonic's prototype SD card digital camera and Bluetooth personal networking cards, and Palm Computing's MP3 player, bar code scanner, and modem card concepts (far right from top).

SONY Satellite Radio

ALPINE Satellite Radio

Radio for All Places

ALL SYSTEMS ARE GO for digital satellite radio to deploy this summer. XM Satellite Radio (car antenna shown, left) will beam signals from space to car receivers like Alpine's CDA-7873 and Pioneer's DEH-P7300. Sony's DRN-XM01 travels from the car into your home. Sirius Satellite Radio, a XM competitor, will be available on car stereos from Clarion, Kenwood, and Panasonic.

AM, FM, or Internet?

INTERNET RADIO becomes another option alongside FM and AM on Philips' FW-i1000 mini-shelf system, the first to provide this feature. Using broadband cable or DSL always-on Internet connections, the FW-i1000 remains connected to the iM Tuning Service, which lets you sort through radio stations by genre, location, or language.

The Everything Communicator

IT'S A CELLPHONE, wireless two-way messaging and e-mail access device, Web browser, and PDA wrapped up in one tiny package. The Accompli 009 from Motorola measures 3.8 by 2.8 by 8.7 inches and weighs 5.7 ounces. But what makes this $550 combo device stand out is its full keyboard and 256-color display. A $75 speakerphone accessory is optional.

Built to Browse

NOW YOU CAN GET Internet access on your TV without a set-top box. Panasonic, EspriTV, and Zenith were all showing off TVs with Internet and e-mail functionality built-in. Just plug in a phone line and you're ready to browse. Panasonic's Internet TV (shown, $799) will also come with a wireless phone jack and keyboard, and 8MB of memory for storing e-mail, weather, news, and stock information.

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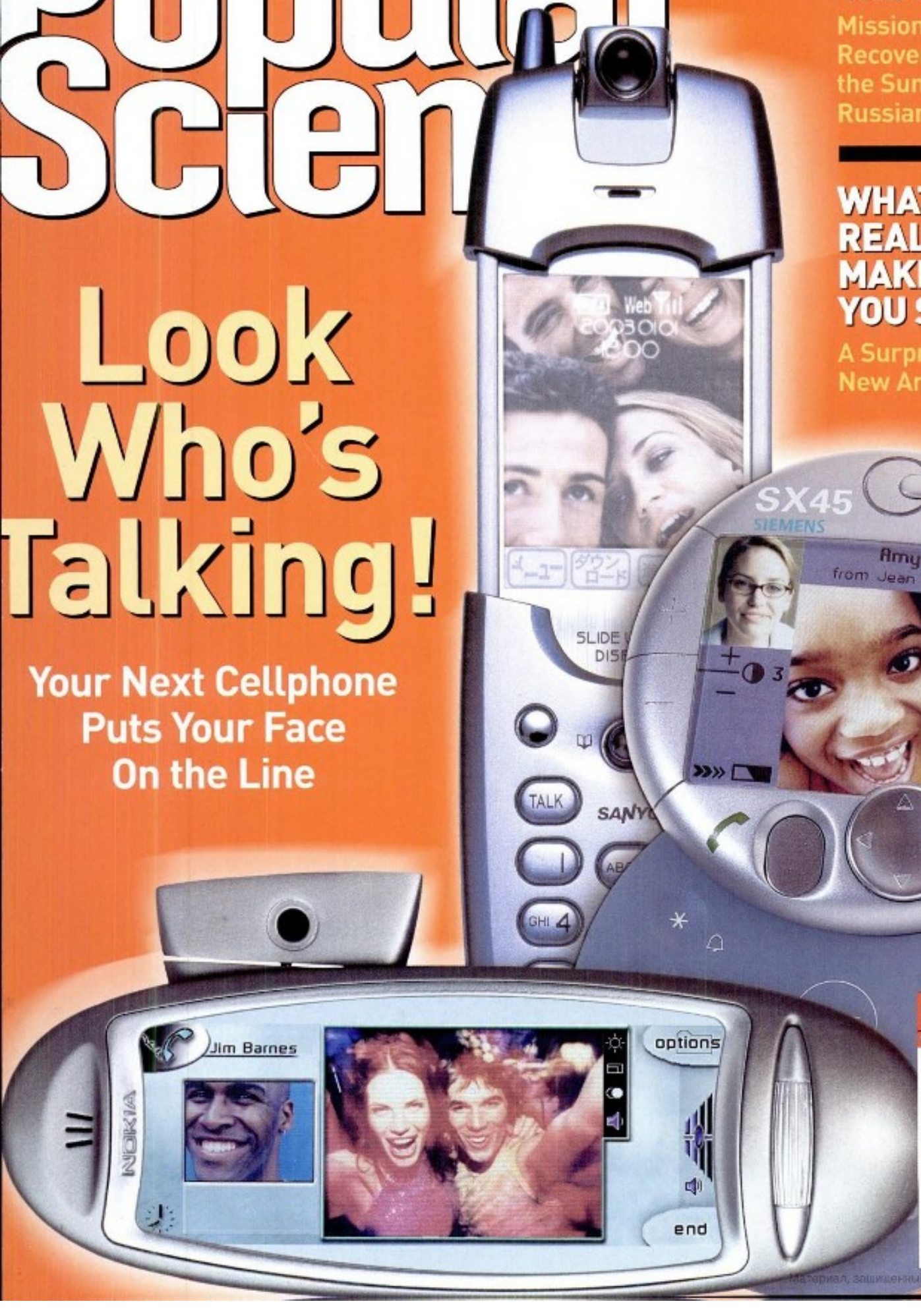
A Surprising New Answer

Look Who's Talking!

Your Next Cellphone Puts Your Face On the Line



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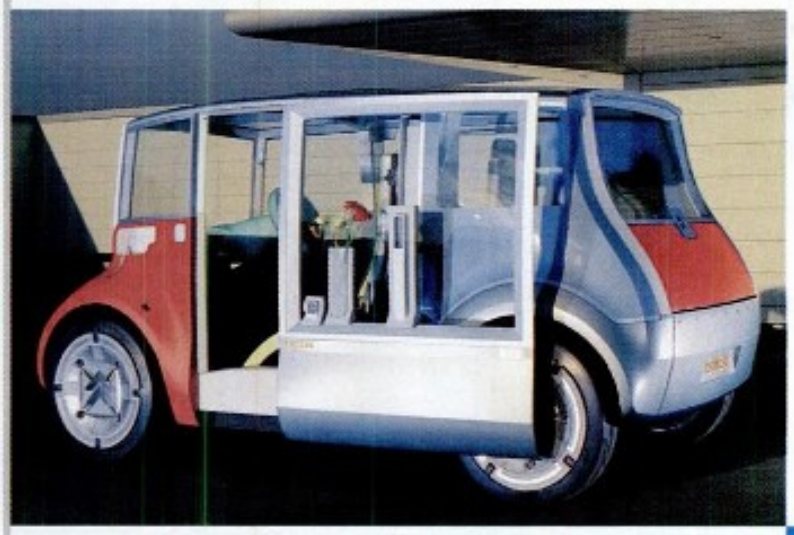


Smart Holster

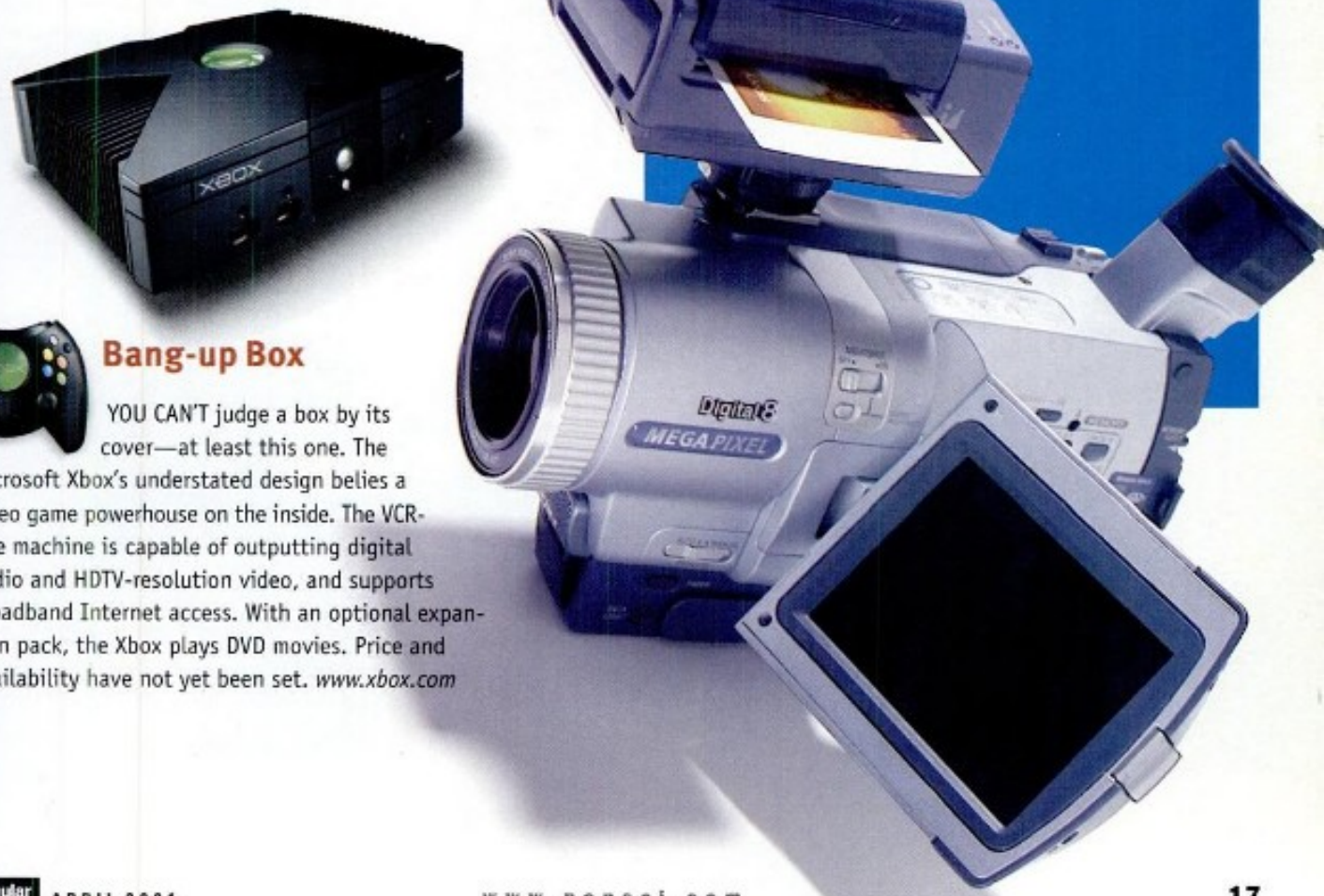
DESIGNED TO keep guns out of the hands of bad guys and children, Uncle Mike's Pro ID Holster is the first to use biometrics. Before a person can remove the gun, the holster verifies his or her fingerprint—the process happens in less than a second. Multiple users can be stored in the holster's memory. Unauthorized users, however, will not be able to remove the gun from the holster. The holster costs approximately $500. *www.uncle-mikes.com*

The Hitchhiker's Friend

"GOING MY WAY?" Soon, French hitchhikers may not have to ask. The Peugeot Citroen Osmose concept has the driver's route map displayed on an exterior body panel (not shown). Passengers going in the same direction can just hop into the rear, outward-facing seats. This altruistic vehicle also has an airbag in its nose that deploys when a sensor detects errant pedestrians. The car, as a gas-electric hybrid, is also environmentally friendly. There are no productions plans yet. *www.peugeot.com*

Prints to Go

SONY'S DCR-TRV830 Handycam Digital8 camcorder ($1,300) turns into a portable picture studio when you attach its PVP-MSH portable color printer. The tiny printer creates 3.5- by 2-inch pictures from a video still on tape or a digital still image stored on the camcorder's Memory Stick. The printer is also a $250 option for Sony's new DCR-TRV330, DCR-TRV530, and DCR-TRV730 Digital8 camcorder models. *www.sony.com*



Bang-up Box

YOU CAN'T judge a box by its cover—at least this one. The Microsoft Xbox's understated design belies a video game powerhouse on the inside. The VCR-size machine is capable of outputting digital audio and HDTV-resolution video, and supports broadband Internet access. With an optional expansion pack, the Xbox plays DVD movies. Price and availability have not yet been set. *www.xbox.com*

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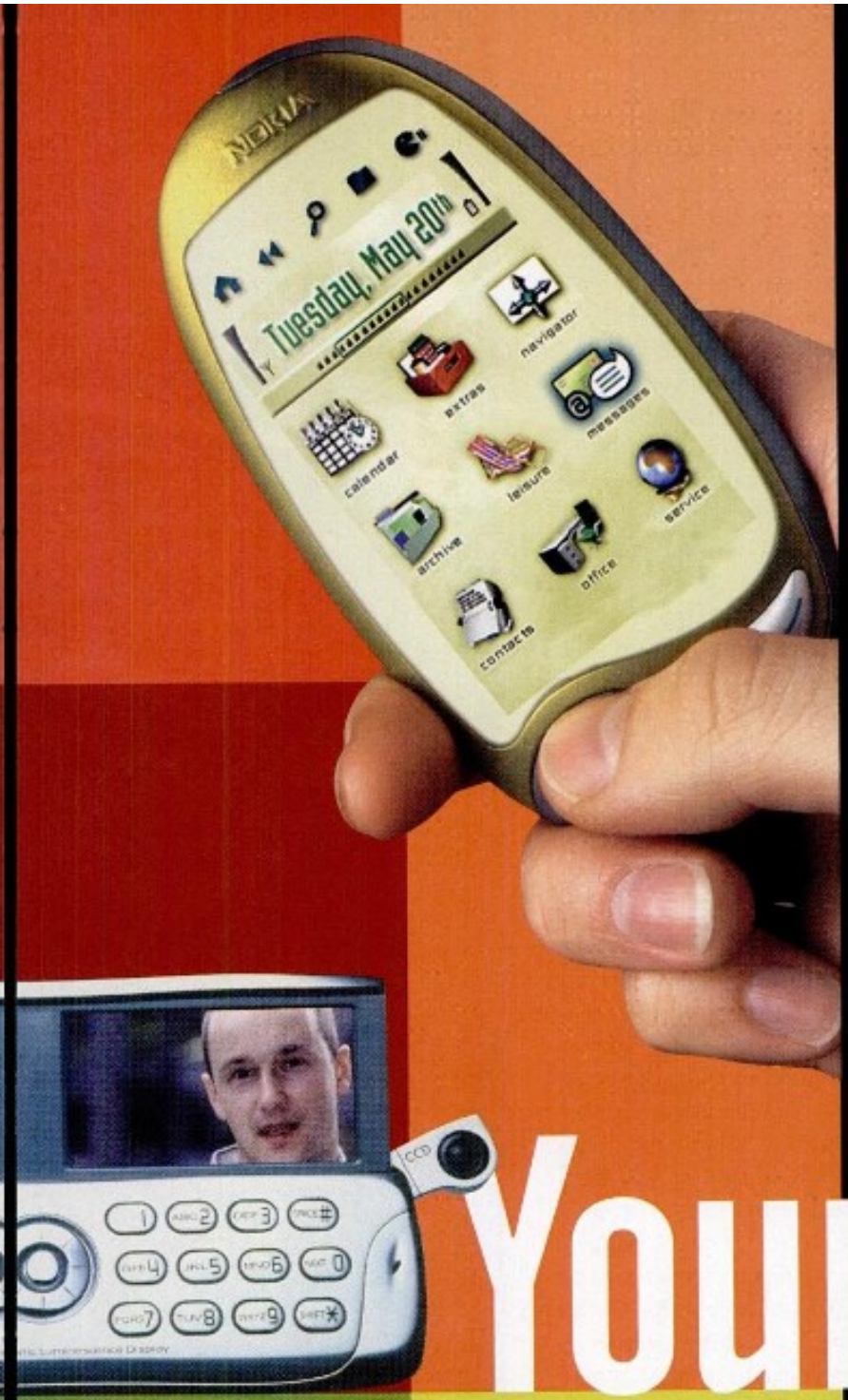
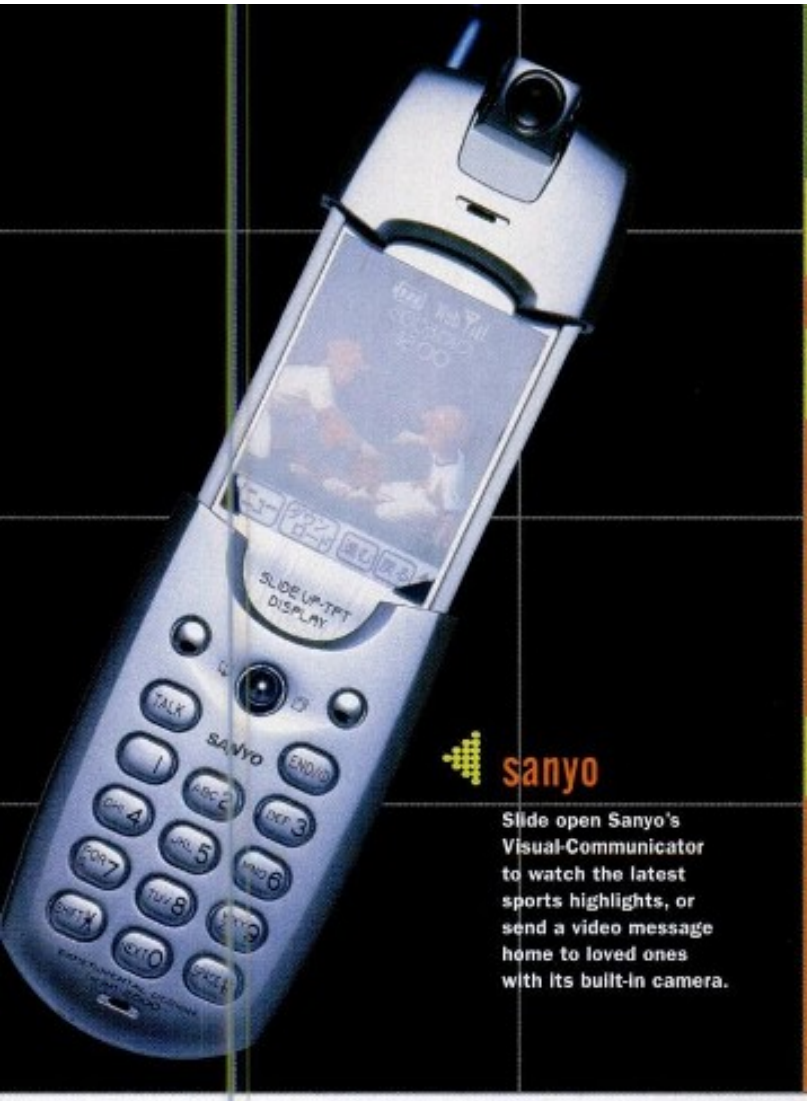


"DO YOU THINK your father would prefer the navy blue tie with the maroon stripes, or the edgier one with the abstract pattern?" asks an anxious-looking woman as she holds the ties up to a tiny video camera. Several miles away, a couple comfortably ensconced in a booth at their favorite restaurant takes time before dessert to review the latest movie trailers and then buy tickets for the next show at the nearest theater. Across town, a man on the way to the airport receives word of a car accident enroute and automatically receives new directions on his car's console display.

Your Next Cellphone

FORGET WHAT YOU KNOW ABOUT CELLPHONES—FUTURE PHONES WILL BE MULTIMEDIA MAVENS.

By Suzanne Kantra Kirschner



sanyo

Slide open Sanyo's Visual-Communicator to watch the latest sports highlights, or send a video message home to loved ones with its built-in camera.

A CELLPHONE TIMELINE

FROM BASIC VOICE service to full-motion video, cellphones have come a long way.

1st Generation 1980s

Bandwidth Required 3Kbps

- Connection to laptop

2nd Generation 1990s

Bandwidth Required 9.6Kbps

- Messaging
- Basic Web browsing
- E-mail
- E-commerce
- Telemetry
- Vertical solutions
- Vehicle location

3rd Generation 2001

Bandwidth Required 384Kbps

- Full Web browsing
- E-mail with attachments
- Richer e-commerce
- Corporate intranet
- Multimedia messaging
- Streaming audio and video
- Online games
- Video telephony
- Music download

nokia

Put your e-mail access, Web browsing, calendar, and contacts literally in the palm of your hand with Nokia's 3G-enabled PDA.

riers in the United States are working on a means of prioritizing certain types of data, such as audio and video. Prioritizing seeks to properly weight the importance of speed to a given application—while you might be willing to wait a couple of extra seconds for an Excel spreadsheet to download, for example, any delays in transmitting a video clip can make for annoying viewing. A reliable method of prioritizing data packets will also enable carriers to split up voice calls into packets of data, instead of dedicating a full channel to each call. With packeted voice calls, the carriers will be able to handle at least twice the volume of calls, which will mean fewer times when you can't place a call due to an overloaded network.

Another key network technology of 3G will be its ability to pinpoint your location to within 50 meters. This capability was mandated by the FCC so that 911 operators can dispatch emergency services to callers who don't know where they are. But armed with your location, carriers could also offer all sorts of location-based services, including driving directions, a list of the closest gas stations, and coupons for nearby retailers. There will, no doubt, be privacy issues associated with this aspect of 3G, but carriers are confident that by using an opt-in policy—in which you choose when or where or with whom to share location data—you will have some control over who knows where you are.

So what will your new 3G phone look like? Perhaps not like a phone at all. In fact, you'll likely have several 3G-enabled products eventually—a phone, an organizer, a game machine, a Web tablet, and maybe even your car. Unlike today's cellphones, many 3G devices will have a broad range of capabilities, including MPEG-4 video and MP3 audio decoding, voice recognition, and Bluetooth personal area networking—making them more akin to computers than phones. And the desire for bigger screens on these more versatile Web and video devices is apt to grow, so not all of them will be as small as your current cellphone either.

One thing won't change: You'll still need to mate your 3G phone with a compatible 3G service, since not all carriers will use the same underlying network standards to achieve their goals. (Initially, 3G devices will work on the cdma2000 and UMTS network protocols.) As always, you'll need to pay attention to the coverage map of your 3G carrier, as it will expand over time. Eventually, there will be combination phones that will work on different types of 3G networks, just as some multi-mode phones today can handle calls over analog, digital, and PCS systems. And with Europe and Asia also moving toward 3G systems, truly global phones may become more commonplace as well.

But first, carriers and phone makers will need to produce on 3G's more basic promises, which have been talked about for more than a decade now. That, finally, should happen soon. Then it's your call.

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Within a few years, scenes like these will become commonplace, thanks to a revolutionary piece of portable technology: your cellular phone. Well, not your current cellphone. But the technology of the cellular phone—and the role that it plays in our lives—will be utterly transformed by something called 3G, or the so-called third generation of wireless telecommunications devices (after analog and digital phones). And if you think you know what it means to own and use a cellphone, you may have to clear your head. The 3G generation will come in a variety of shapes, sizes, and services, some of which hardly resemble the portable gabbers we know and love (or simply tolerate) today.

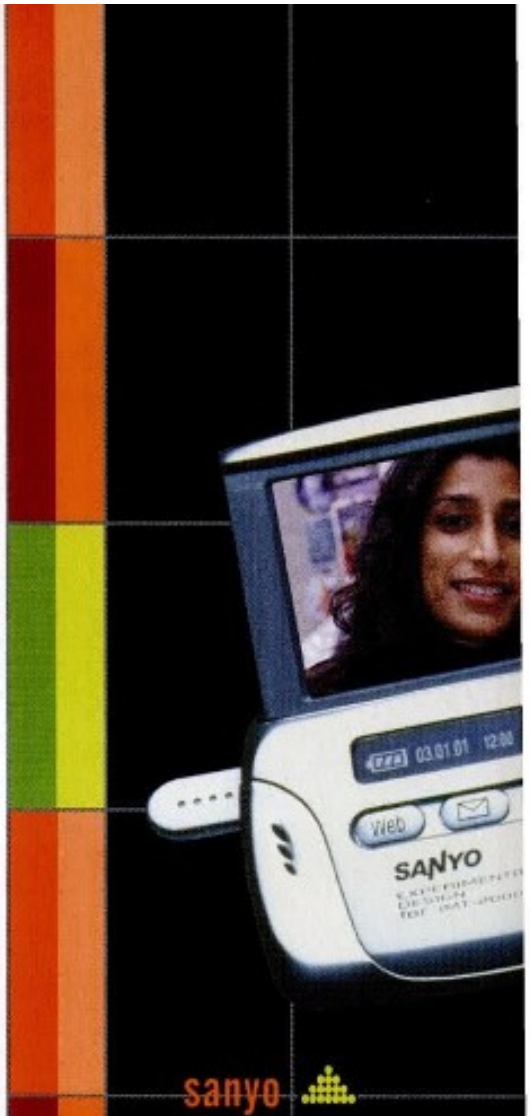
What exactly will 3G cellular mean? According to the standards already laid out by the International Telecommunication Union, 3G mobile devices will provide wire-line voice quality and very fast data rates for a wireless device—a minimum of 144Kbps, or roughly three times what most of us can squeeze out of a regular phone line with a 56Kbps modem. Those high data rates are expected to make practical a variety of audio and video services, such as music downloads, Internet radio, videoconferencing, and video e-mail. In addition to these functions, which will be provided via the new 3G networks, the pocket-sized devices we carry around will be packed with perks, such as color displays, removable storage media, and text-to-speech capabilities.

As with the changeover from first-generation analog cellular technology to second-generation digital technology, 3G's ramp-up from possibilities to realities will take some time. The first digital cellular phones of the early 1990s were large by today's standards and did just one thing: make or receive calls. Analog cellular modem cards did let you browse the Web with your laptop. But the phones themselves merely acted as dumb phone jacks. Today, you can purchase phones that are barely larger than chewing gum packs, can store hundreds of numbers, browse the Web, organize your day, and play MP3 music. The first 3G handsets will start out with these capabilities and go from there.

But there's work to be done first. The foundation for these new 3G handsets and services lies in the networks. Service providers, such as AT&T Wireless and Sprint PCS, need to upgrade their existing cellular networks to support higher data rates, locate individual users, and prioritize packets of information so they can move from place to place much faster. When the first 3G services roll out later this year from Sprint PCS, you'll be able to browse the Web or receive various information services at speeds up to 144Kbps, or up to 10 times faster than the carrier's current capabilities. At busy times of day, you could expect speeds of perhaps 70- to 80Kbps. Sprint PCS says its network, which will use the cdma2000 (code-division multiple access) standard, should reach top speeds of 307Kbps by 2002, and go as high as 3- to 5Mbps by late 2003. At these high speeds you could listen to an audio clip or view a movie trailer streamed in real time from a Web site. And your connection is always "on"—you're connected at the press of a button without any waiting.

Sprint PCS, of course, isn't the only wireless carrier that will supply 3G service. AT&T Wireless is building a new wireless network based on the GSM (Global System for Mobile communication) standard, which should begin operating in 2002 and gradually move in three steps from speeds of 115Kbps to 2Mbps. The final standard will be UMTS (Universal Mobile Telecommunications System, which some providers call Wideband Code-Division Multiple Access), which will deliver speeds of 2Mbps. To benefit from each of these speed bumps as they become available, whether from AT&T or Sprint or someone else, you'll need a new 3G phone. And with color displays on the outside and lots of gadgetry inside, such phones may not come as cheaply as cellphones do today.

In addition to increasing the raw speed of their data deliveries, 3G car-

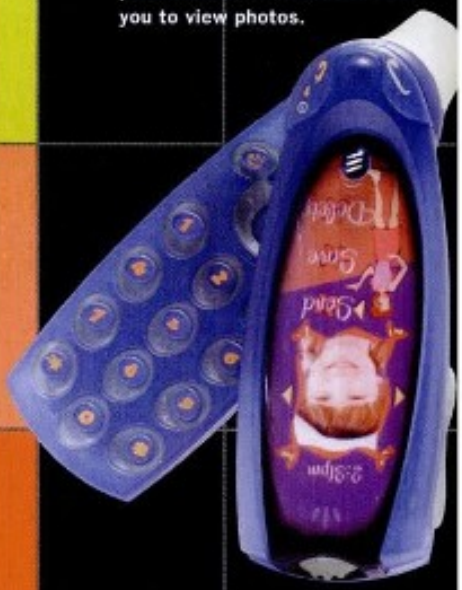


sanyo

The Multi-Communicator looks and works like a regular cellphone when closed. But open it and it becomes a videoconferencing terminal.

ericsson

Though designed primarily for voice calls, this palm-size cellphone's color LCD also enables you to view photos.



THE LOOK OF THINGS TO COME

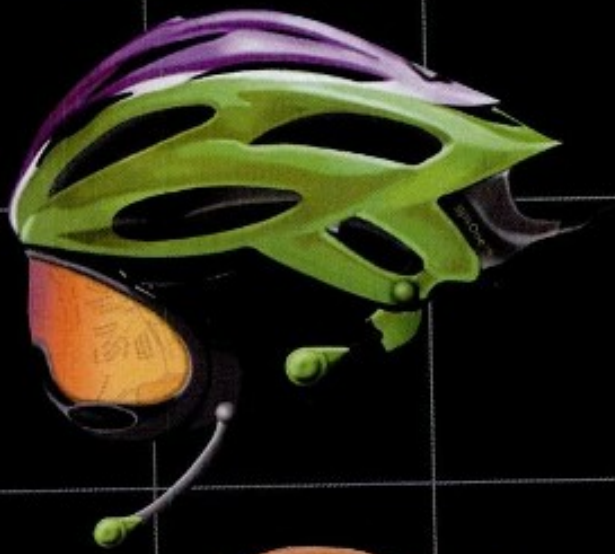
TRY TO CLEAR YOUR MIND of any preconceptions you may have about what a cellphone is. The multifunction devices that will work on next-generation 3G networks will come in a variety of shapes and sizes.

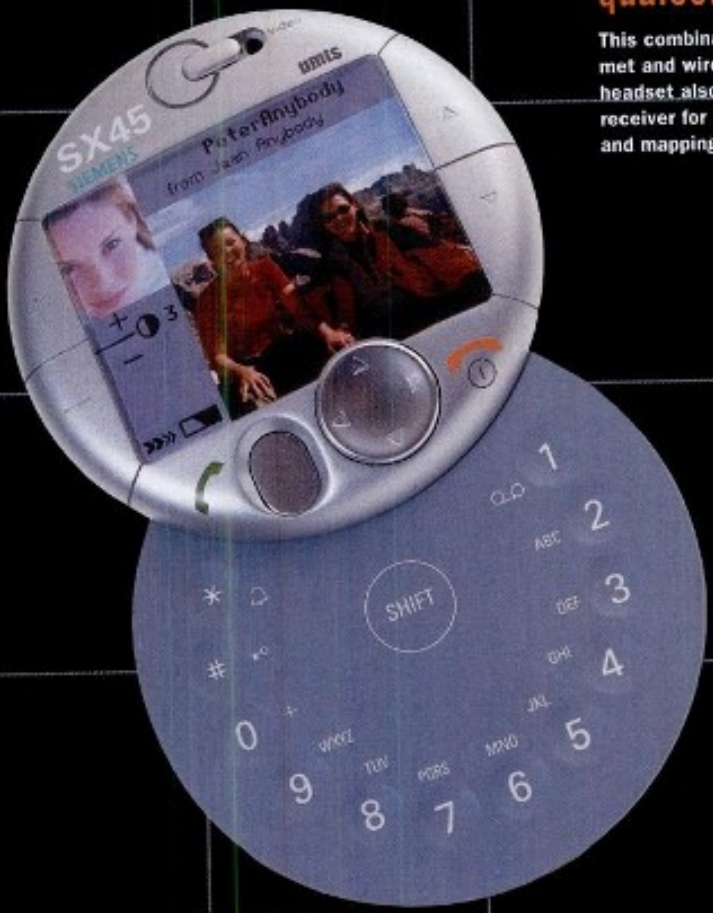
ericsson

Built for full-time use as a PDA, Ericsson's RX 1 doubles as a cellphone when you remove its wireless earpiece.

qualcomm

This combination bike helmet and wireless phone headset also features a GPS receiver for accurate routing and mapping information.





siemens

Hidden behind the SX45 videophone's sleek surface lies a surprisingly old-fashioned dial-pad design.

fujitsu

Rugged enough for the most hearty handling, Fujitsu's combination PDA-videophone makes its large color display the focal point.

Fantastic party carts you can build

Tempest | Plymouth test—to the screeching limit

POPULAR MECHANICS

FEB. 1966
35 CENTS

BREAKTHROUGH: you can watch both sides of this flat-tube color TV!

Bonus Tearout! Wall Fasteners

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Fantastic new portable color tv set has flat picture tube you can watch from both sides. New flat-tube development is first step toward practical hang-on-the-wall television for your living room.

BY Larry Steckler

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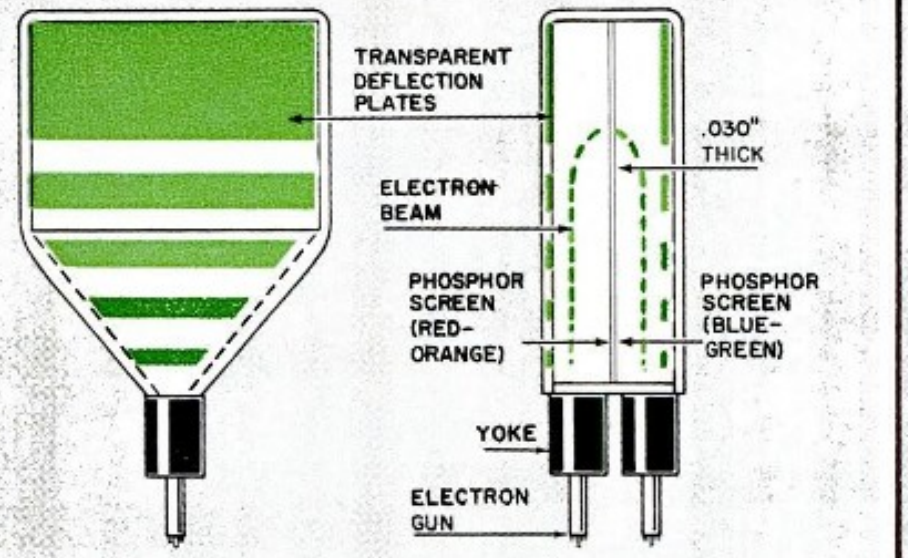

THINNEST COLOR picture tube gives up its secrets in detailed PM sketches

FLAT TV PICTURE TUBES ARE REALLY HERE. There are both color and black-and-white versions. I know. I've seen them in action. I've held them in my hands. And you'll soon be seeing them in a new breed of portable TVs sporting a famous maker's label around the end of this year.

Now settle back and we'll let you in on the news. Out in the suburbs of Los Angeles are the business offices of the Intertel Corp. And inside these offices some remarkable things have been going on. They've developed a flat color-picture tube like the one diagramed above. It has a 6-inch screen that gives a perfectly rectangular viewing area, 4¾ x 3½ inches. Best of all it's a tiny 2⅜ inches thick. When combined with a transistor color TV chassis it makes a color set that's a mere 10 x 6 x 3½ inches, weighs six pounds and costs about $200. Just the right size to take along on your next trip. They've come up with a monochrome (black-and-white) portable too, and it's even smaller —9 x 4½ x 2¼ inches—and costs $150.

While only small-screen versions of the flat picture tubes have been built so far, there is no limit to the size tube that

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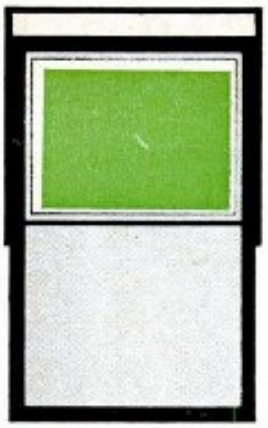


can be built. Scaling-up, a 23-inch rectangular tube would be about 4 inches thick. You could certainly hang it on your living room wall and probably will.

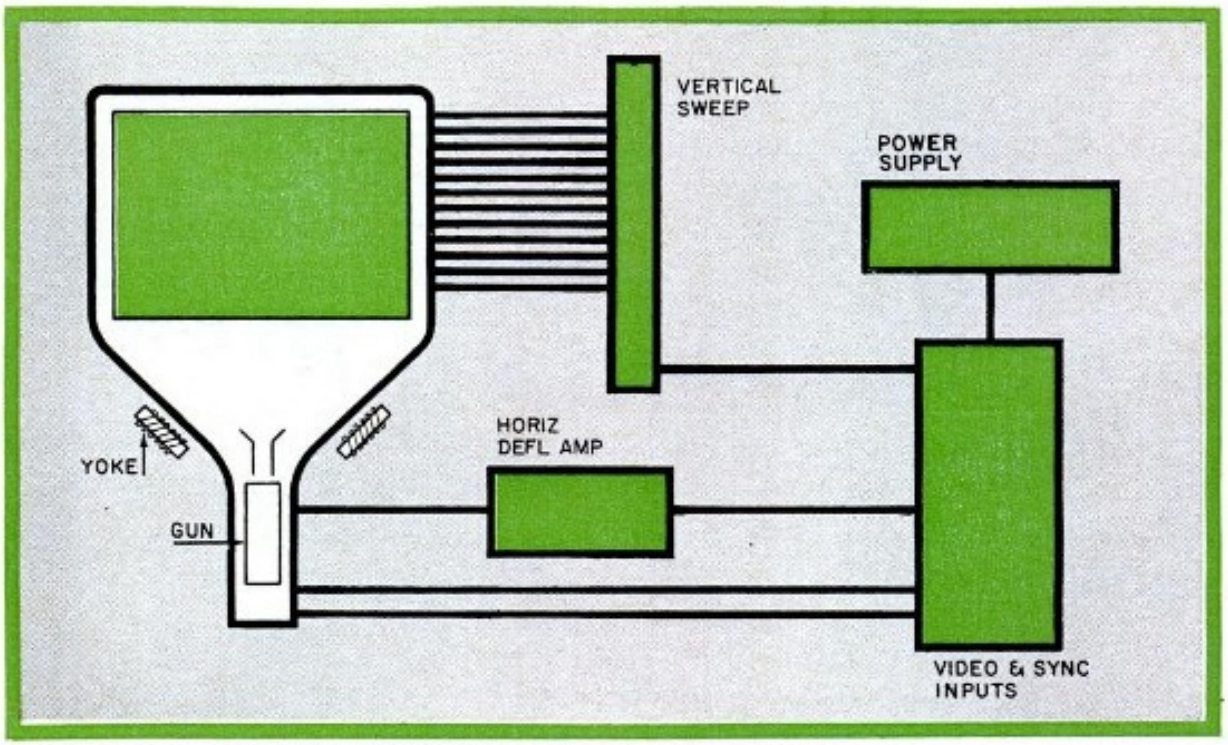
The Intertel sets are unique in several ways other than their use of the flat tube. To me, the most fascinating feature of all is that the picture can be viewed from either side of the tube. Of course, it appears in reverse on the back side, but it's a great way of making a small-screen portable viewable by a greater number of people.

Early models of the set will be viewable only from the front as the space behind the picture tube will be taken up by some electronic circuitry. Later versions may include the two-sided viewing if the public demands it. I think it will. The cabinet will be enlarged slightly to make room for the wiring that would otherwise block off the rear of the tube.

The color tube is unique in itself. It is a two-color tube that uses two electron guns and two phosphor screens instead of the three-gun system now accepted as the standard. It does this by combining the colors (red orange and blue green), following a specially developed additive system inside the tube, to give full color reproduction. Actually, at least to my eye, there are some discrepancies in the color reproduction. The two-color flat tube cannot deliver a true purple or a dark, intense blue. But flesh tones are more real than anything I've seen before and if these tones are right I doubt if you'll even know that the female singing star is wearing a purple dress and not the reddish-blue one you see.

Even more important is that the two-color tube gives a considerably brighter picture than the conventional color tube. This is vital to a portable TV that will be used outdoors every so often. The picture on a standard color set can barely stand up against normal room lighting. Outdoors it would be completely washed out and impossible to view.

Since the flat tube is quite different from conventional picture tubes, it works a bit differently too. Look at the diagram at the top of page 91. You'll note that



SCANNING CIRCUITS ARE DIFFERENT. Block diagram shows the basic arrangement of horizontal and vertical sweep circuits required by the new flat tube. Each corner of the screen is perfectly square

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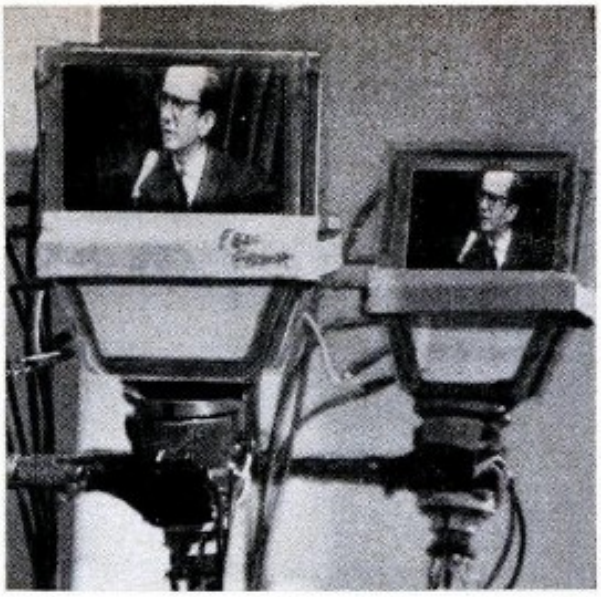
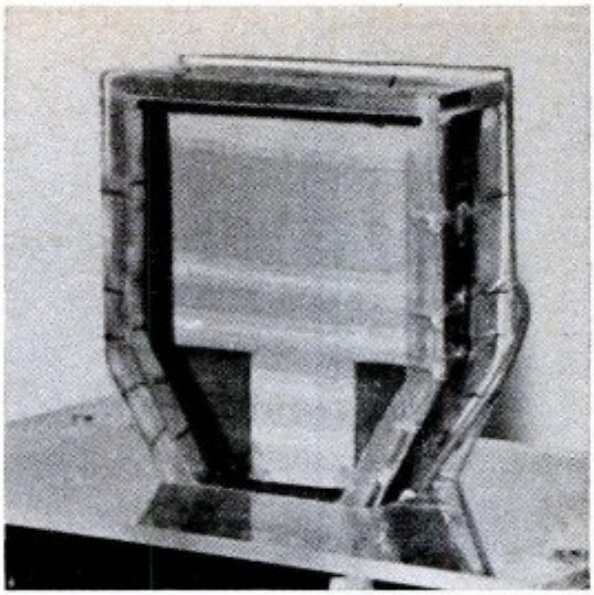


MONOCHROME TUBE IN ACTION. Mirror behind tube lets you see image on the rear. It appears right side up as mirror inverts reverse picture



FLAT COLOR TUBE is two monochrome tubes back-to-back. Dual phosphor screen is in middle. Electron beams are directed to it from both faces

INVENTOR WITH HIS BRAINCHILD. Leo Shanafelt, top-notch engineer behind the flat tube, works at his laboratory bench where he has the monochrome tube set up for another round of experiments

there are two electron guns at the bottom of the tube: one for each of the two phosphor screens. These screens are deposited on opposite surfaces of a thin (.030-inch) sheet of glass.

This dual screen is firmly fastened in the exact center of the tube. The electron guns fire a beam of electrons straight up behind the screen from either side. The yoke around the neck of the tube deflects the beam from side to side. The transparent deflection stripes on each face of the tube, directed by signals from the set's deflection circuits, deflect the beams against their respective phosphors to produce a picture.

The monochrome tube is a bit simpler as it has only one electron gun and one set of deflection stripes. On the crude handmade tubes I watched, these stripes are just barely visible as slightly darker portions of the screen while a picture is being viewed. In production versions of the tube these stripes should be completely invisible.

The advantages of a flat tube are many and varied. Some are quite obvious;

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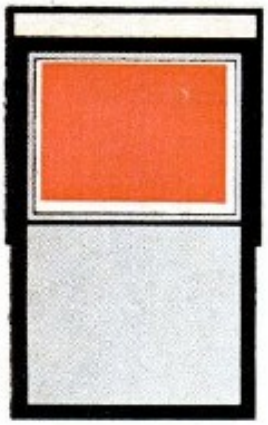


some not quite so apparent. Here are the most important ones:

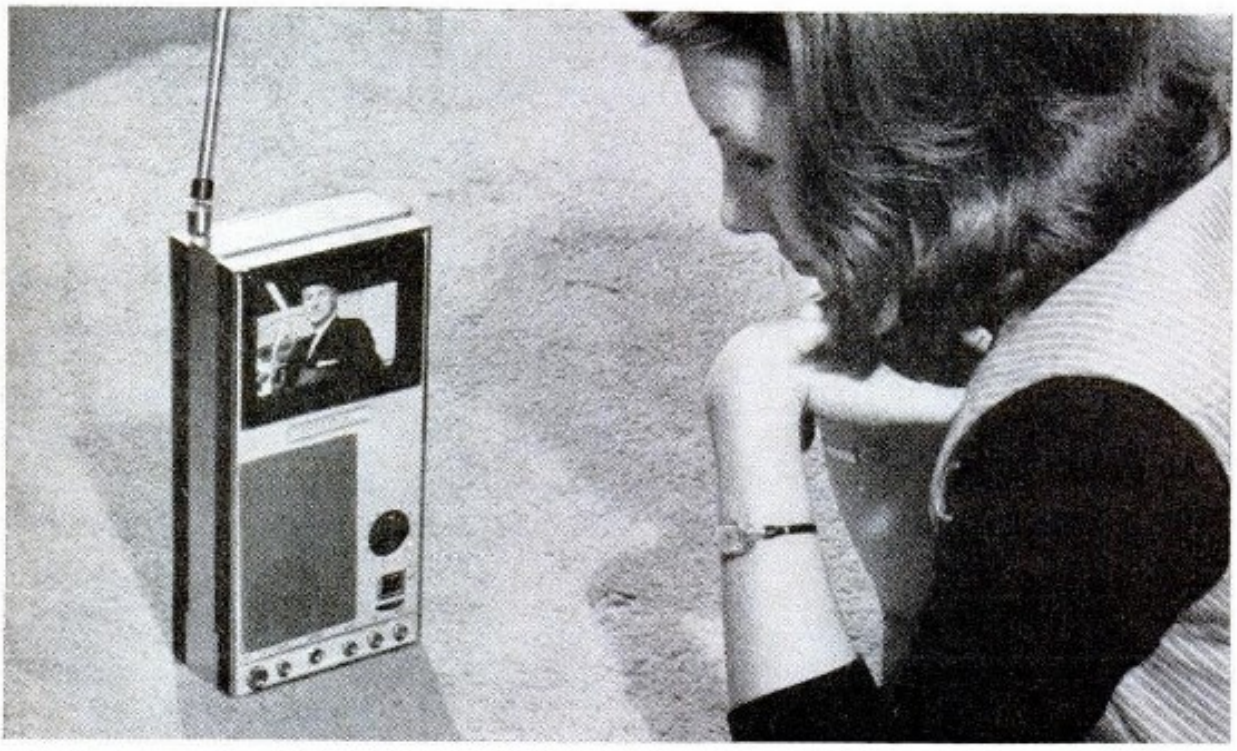
- Flat-tube sets are extremely thin, especially when compared to present-day models. They are easier to fit into a crowded room and do not take up floor space.
- Smaller, more compact TVs are possible. This means greater portability, lighter weight.
- Picture tubes are less complex. Specially blown glass envelopes are no longer needed. Ordinary plate-glass screens are easy to make.
- Two-sided viewing can be provided, if desired.
- Truly miniature, book and pocket-size sets become feasible. You may be looking for one soon.

Now let's look at a tiny flat-tube portable and see what we can do with it. Like a transistor radio, it can go anywhere. It's light and extremely portable. You can pass it to the kids to keep them occupied during long auto trips. You can take it with you to the beach or take it along on your winter ski tours. Or, for that special-occasion telecast you would give anything to see, bring it with you to your job—if you have an understanding boss.

In your home, large-screen sets will be built into the walls; they can be that thin. Those who like to watch TV in bed will be able to fit a set into the ceiling. Exotic styling for tabletop sets will become standard and remote controls for operating the set from your seat will be a must.

Other changes in set design resulting from the flat tube, as well as innovations in the tube itself, are bound to outreach my imagination. I'm sure that one day we'll have wall-sized screens made out of a flexible luminescent material that we can roll up out of sight when not in use. We may even end up with three-dimensional color TV.

But no matter which direction TV may take in the future, the industry is—right now—accomplishing a major breakthrough. The set manufacturers have been given a new ball to play with and I, for one, intend to keep tabs on what they do with it. ★★★



HER FIRST CLOSE-UP GLIMPSE of a flat TV portable in action utterly fascinates pretty *PM* secretary Millie Pedersen. Now, all she wants to know is how soon she can get one and how much it will cost

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